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A Framework for Assessing Electronic Commerce Success

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ABSTRACT

Organizations are adopting electronic commerce for a variety of reasons. Many companies are adopting e-commerce in order to stay in the business. Others (for example Banks) are adopting e-commerce in order to minimize cost of transaction. The obvious question is: are they successful? The literature does not provide any framework for assessing e-commerce success. This study attempts to fill this gap by developing a framework of e-commerce success using operational-quantitative and strategic-qualitative approaches. The use of both approaches aims to create a comprehensive and robust measurement model. Key factors impacting electronic commerce are identified from detailed literature review. These factors are then differentiated according to their contribution to the success of electronic commerce and according to the locus of impact. The final model is then cast in structural equation modeling framework.

Key words: Electronic commerce, Structural equation modelling

INTRODUCTION

Electronic commerce, both Internet based or otherwise, is changing the way organizations are performing their tasks, interact with customers and, in general, do their business. Electronic commerce is not only 'buying and selling' of product via electronic means, it involves all other activities to support the sale process (Applegate et al., 1996). We adopt the definition of electronic commerce as provided by Wigand (1997) and Kalakota & Whinston (1997) as follows: "electronic commerce includes any form of business activity conducted via electronics means, which might range from products/services information to selling and/or buying products/services".

Though the need to assess the impact of electronic commerce is recognized, it is not an easy task to measure it. The lack of such measures could result in difficulties when assessing the performance of e-commerce relative to alternative strategies (Rose et al., 1999). The problems in measuring general IS success was highlighted by Delone (1992). The author argued that study in this particular area has been elusive, since each author may define IS success quite differently. With regard to electronic commerce success, a similar problem prevails. Some researchers use technical-quantitative measures such as hit and page view (Kroll, 2000; Rose et al., 1999). Others may use qualitative assessments, for example the firm’s goal attainment and competitive advantage (Ng et al. 1998). These inconclusive results, then, call for a more comprehensive electronic commerce success measure that can accommodate multiple criteria of success.
This study thus aims to develop a framework for assessing electronic commerce success. In doing so, the factors affecting e-commerce success are identified from a comprehensive literature review. The framework provides four scenarios for factors affecting electronic commerce success. They are classified as ‘drivers’ and ‘impediments’ of e-commerce success, and whether the impacts are “internal” or “external” to the organization. In the next several sections we first provide theoretical perspectives on factors of electronic commerce success. We then provide detailed description of the key factors followed by the proposed e-commerce success model. Conclusions and future work are then presented.

**THEORETICAL PERSPECTIVE ON FACTORS AFFECTING ELECTRONIC COMMERCE SUCCESS**

We develop the electronic commerce success framework using a multiple criteria approach. It is suggested that the success or failure of electronic commerce is largely determined by its ability to minimize the impediments and to enhance the drivers. To obtain comprehensive understanding of the electronic commerce impacts, these dimensions need to be differentiated further according to the locus of impacts, i.e. whether they are internal or external to the organization. The internal impacts include benefits and impediments of company using e-commerce. The external impacts consist of benefits and impediments with respect to the external parties such as customers and suppliers. The framework is shown in table 1 below.

**Table 1: Electronic Commerce Success Framework**

<table>
<thead>
<tr>
<th>Locus of Impact</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>Cost Leadership</td>
<td>Product Pricing</td>
</tr>
<tr>
<td></td>
<td>Reputation</td>
<td>Time Spent</td>
</tr>
<tr>
<td></td>
<td>Market</td>
<td>Convenience</td>
</tr>
<tr>
<td></td>
<td>Business Entry</td>
<td>External Relationship</td>
</tr>
<tr>
<td>Impediment</td>
<td>Financial Risks</td>
<td>Customer’s Expense</td>
</tr>
<tr>
<td></td>
<td>Expertise</td>
<td>Delivery Time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transaction Risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access</td>
</tr>
</tbody>
</table>

**ELECTRONIC COMMERCE DRIVERS AND IMPEDIMENTS**

The literature suggests a number of positive impacts of electronic commerce. Among them, cost saving is the most cited one. E-commerce enables firms to reduce the telecommunication costs, minimizes warehousing expenses, and cuts down the distribution chain leading to cost savings. Firms are also benefited by the global reach of electronic commerce since it means the wider market base and opportunities to increase market share.

However, a number of authors also suggest some factors that may hinder the benefits of electronic commerce. Financial consideration is often mentioned as inhibitor to the adoption of electronic commerce (PricewaterhouseCoopers, 1999). Computer and networking technology are still considered as expensive, therefore many companies, especially the SMEs, cannot afford the total costs of ownership (TCO) of electronic commerce (De' and Mathew, 1999; Nath et al., 1998). In addition, legal and liability issues are also perceived as matter of concern. The borderless nature of e-commerce adds further complexity to the problems. Table 2 presents past research on e-commerce and categorizes them in terms of Drivers (internal and external) and Impediments (internal and external). It is interesting to note that most of the authors (17 of them) dealt with internal drivers, followed by external drivers (13), and internal and external impediments (7 each). Most of the past studies, therefore, dealt with the “benefits” of e-commerce than its “costs".
Table 2: A Summary of Research on the Factors Affecting the Success of Electronic Commerce

<table>
<thead>
<tr>
<th>Authors</th>
<th>Research Approach</th>
<th>Sample</th>
<th>Industry</th>
<th>Internal Drivers</th>
<th>Internal Impediments</th>
<th>External Drivers</th>
<th>External Impediments</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Auger and Gallaugher, 1997)</td>
<td>Survey</td>
<td>141</td>
<td>SMEs</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Benjamin and Wigand, 1995)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Brynjolfsson and Smith, 2000)</td>
<td>Survey</td>
<td>41</td>
<td>Retail</td>
<td>✅</td>
<td></td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Chan and Swatman, 2000)</td>
<td>Case study</td>
<td>1</td>
<td>Steel Company</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(De' and Mathew, 1999)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Ghosh, 1998)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Grover and Ramanlal, 1999)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Keeney, 1999)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Malone et al., 1987)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nath et al., 1998)</td>
<td>Interview</td>
<td>10</td>
<td>Mixed</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>(Ng et al., 1998)</td>
<td>Survey</td>
<td>98</td>
<td>Mixed</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Palmer, 1997)</td>
<td>Survey</td>
<td>120</td>
<td>Retail</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Poon and Swatman, 1999)</td>
<td>Survey</td>
<td>59</td>
<td>SMEs</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Poon and Swatman, 1998)</td>
<td>Survey and Case Study</td>
<td>23</td>
<td>SMEs</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PricewaterhouseCoopers, 1999)</td>
<td>Survey and Interview</td>
<td>N/A</td>
<td>SMEs</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Riggins, 1999)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Rose et al., 1999)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Saunders, 2000)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Shon and Swatman, 1998)</td>
<td>Delphi survey</td>
<td>19</td>
<td>Mixed</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Strader and Shaw, 1997)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Strader and Shaw, 1999)</td>
<td>Survey</td>
<td>48</td>
<td>Mixed</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Venkatraman, 2000)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Wigand, 1997)</td>
<td>Conceptual overview</td>
<td>N/A</td>
<td>N/A</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MEASURES OF E-COMMERCE SUCCESS

Prior studies suggest that there were no conclusive measures of electronic commerce success. A number of studies suggest the use of computer-reported measures that are considered as more objective (Straub et al., 1995), for example number of ‘hit’. However, the use of ‘hit’ as a measure could be less meaningful than other measures and can be misleading (Ayres, 2000). Using the hit as a measure, the number of people visiting the web site is counted based on the number of IP addresses that download pages from a site. A problem will arise when visitors use the Internet from public facilities such as offices and schools. The web site will only record one individual from that IP address, regardless of the number of people from that particular place visiting the same site. Another problem could emerge from internal maintenance activities. The employees who perform the job will be regarded as visitors. Therefore, the ‘hit’ measure will still count them (Rose et al., 1999).

Due to the limitation of ‘hit’, other measures have been proposed to obtain better measures. ‘Page view’ might be considered as better since it brings in time variable rather than simply counting the number of visitors. It shows the number of pages a visitor downloads over a given period (Kroll, 2000). Alternatively, ‘stickiness’ can also be used to measure a web site’s performance. It tells how long each visitor remains on a site (Kroll, 2000). The longer they remain on a site, the more chances are that they will buy the products offered. Finally, the ‘conversion rate’ is a comprehensive measure and is regarded as more powerful than other measures. This metric is obtained by dividing the number of visitors over a period of time by the number of visitors who take some action, such as purchase (Gurley, 2000).

There are also strategic-qualitative measures, which can be used for electronic commerce success. As demonstrated by Sethi and King (1994) competitive advantage, achieved from the use of IT applications, can also be adapted for electronic commerce, i.e. competitive advantage attained due to e-commerce applications. DeLone and McLean (1992) measure IT success in terms of the firm’s goal attainment, which can also be adapted for e-commerce success.

Rather than depending on one approach, this study uses both operational-quantitative and strategic-qualitative approaches to measure electronic commerce success. Table 3 presents the drivers, impediments, and e-commerce success measures along with the corresponding literature. We describe these factors in the next section.
### Table 3: Electronic Commerce Dimension and Proposed Measures

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measures</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Leadership</strong></td>
<td>E-commerce enables cost savings in performing business activities.</td>
<td>(Benjamin and Wigand, 1995), (Auger and Gallaugher, 1997), (Ng et al., 1998), (Poon and Swatman, 1999), (Grover and Ramanlal, 1999), (Venkatraman, 2000) (Malone et al., 1987; Poon and Swatman, 1998; Wigand, 1997)</td>
</tr>
<tr>
<td></td>
<td>E-commerce enables a reduction in warehousing costs.</td>
<td>(Chan and Swatman, 2000)</td>
</tr>
<tr>
<td></td>
<td>E-commerce enables a reduction in distribution costs.</td>
<td>(Benjamin and Wigand, 1995), (Ghosh, 1998), (Ng et al., 1998), (Riggins, 1999)</td>
</tr>
<tr>
<td></td>
<td>Marketing costs become lower using e-commerce.</td>
<td>(Strader and Shaw, 1997), (Auger and Gallaugher, 1997), (Nath et al., 1998), (Poon and Swatman, 1999)</td>
</tr>
<tr>
<td><strong>Reputation</strong></td>
<td>Using e-commerce leverages the firm’s reputation.</td>
<td>(Auger and Gallaugher, 1997), (Nath et al., 1998), (Poon and Swatman, 1998) (De’ and Mathew, 1999)</td>
</tr>
<tr>
<td><strong>Market</strong></td>
<td>E-commerce enables the firm to expand the base of consumers both nationwide and overseas.</td>
<td>(Auger and Gallaugher, 1997) (Poon and Swatman, 1998) (Nath et al., 1998) (Riggins, 1999)</td>
</tr>
<tr>
<td></td>
<td>E-commerce enables the firm to collect information from consumers and web visitors.</td>
<td>(Auger and Gallaugher, 1997) (Ng et al., 1998) (Poon and Swatman, 1999)</td>
</tr>
<tr>
<td></td>
<td>E-commerce consumers have better education and are more affluent than average consumers.</td>
<td>(Auger and Gallaugher, 1997) (Poon and Swatman, 1998)</td>
</tr>
<tr>
<td><strong>Business Entry</strong></td>
<td>There is no barrier for entry to conduct business using e-commerce.</td>
<td>(Nath et al., 1998)</td>
</tr>
<tr>
<td>Dimension</td>
<td>MEASURES</td>
<td>Sources</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Financial</td>
<td>E-commerce reduces profit margin per product or per transaction.</td>
<td>(Benjamin and Wigand, 1995)</td>
</tr>
<tr>
<td></td>
<td>The organization is concerned about the total cost of e-commerce ownership (e.g. set up cost, connection cost, hardware cost, and maintenance cost).</td>
<td>(Nath et al., 1998), (De' and Mathew, 1999) (PricewaterhouseCoopers, 1999) (Saunders, 2000)</td>
</tr>
<tr>
<td>Risks</td>
<td>E-commerce increases security risk.</td>
<td>(Kalakota and Whinston, 1996)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(De', 1999 #318) (Rose et al., 1999)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Saunders, 2000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Furnell and Karweni, 1999)</td>
</tr>
<tr>
<td></td>
<td>It is difficult to monitor visitor activities in firm's web site.</td>
<td>(Auger and Gallaugher, 1997)</td>
</tr>
<tr>
<td></td>
<td>Legal issues are matter of concern in e-commerce transactions.</td>
<td>(Nath et al., 1998) (PricewaterhouseCoopers, 1999)</td>
</tr>
<tr>
<td>Expertise</td>
<td>It is difficult to obtain experts in e-commerce</td>
<td>(Nath et al., 1998)</td>
</tr>
</tbody>
</table>

**External Driver**

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>Measures</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Pricing</td>
<td>E-commerce provides products and/or services cheaper than retail-shop.</td>
<td>(Palmer, 1997), (Strader and Shaw, 1997) (Strader and Shaw, 1999), (Byrnolffson and Smith, 2000)</td>
</tr>
<tr>
<td>Time Spent</td>
<td>E-commerce allows for faster processing of customer orders.</td>
<td>(Kalakota and Whinston, 1997)</td>
</tr>
<tr>
<td></td>
<td>E-commerce allows consumers to find and select products faster.</td>
<td>(Lynch and Lundquist, 1996)</td>
</tr>
<tr>
<td>Convenience</td>
<td>E-commerce allows consumers to shop at the firm’s virtual shop anytime.</td>
<td>(Saunders, 2000)</td>
</tr>
<tr>
<td></td>
<td>E-commerce allows the firm to offer personalized services for customers.</td>
<td>(Venkatraman, 2000) (De' and Mathew, 1999)</td>
</tr>
<tr>
<td></td>
<td>E-commerce allows consumers to pay online.</td>
<td>(Shon and Swatman, 1998)</td>
</tr>
<tr>
<td></td>
<td>Consumers can perform transactions easily.</td>
<td>(Venkatraman, 2000) (Riggins, 1999)</td>
</tr>
<tr>
<td>External Relationship</td>
<td>E-commerce enables the firm to provide 24 hours, 7 days a week customer service.</td>
<td>(Auger and Gallaugher, 1997) (Riggins, 1999)</td>
</tr>
<tr>
<td></td>
<td>E-commerce improves information exchange with suppliers and customers.</td>
<td>(Ghosh, 1998) (Riggins, 1999) (PricewaterhouseCoopers, 1999)</td>
</tr>
</tbody>
</table>

**DIMENSION**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measures</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer’s Expense</td>
<td>Consumers performing online transaction incur higher costs than retail shopping consumers.</td>
<td>(Keeney, 1999) (Strader and Shaw, 1999)</td>
</tr>
<tr>
<td></td>
<td>Delivery cost is a consumer’s concern when conducting transaction online.</td>
<td>(Strader and Shaw, 1999)</td>
</tr>
<tr>
<td><strong>Delivery Time</strong></td>
<td>Delivery time is a consumer’s concern when conducting transaction online.</td>
<td>(Palmer, 1997)</td>
</tr>
<tr>
<td><strong>Transaction Risk</strong></td>
<td>Security is a consumer’s concern when conducting transaction online.</td>
<td>(Auger and Gallaugher, 1997) (Nath et al., 1998) (Rose et al., 1999) (Furnell and Karweni, 1999)</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>Slow internet access is a barrier for consumers in conducting transactions online.</td>
<td>(Auger and Gallaugher, 1997) (Rose et al., 1999)</td>
</tr>
</tbody>
</table>

Electronic Commerce Success

**Strategic**

<table>
<thead>
<tr>
<th><strong>DIMENSION</strong></th>
<th>Measures</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm’s Goal</td>
<td>What is e-commerce contribution to meet firm’s goal?</td>
<td>(Delone and McLean, 1992)</td>
</tr>
<tr>
<td>Competitive Advantage</td>
<td>Overall, the competitive advantage provided by e-commerce is (if e-commerce was a defensive move aimed at countering a threat, the overall success of the system has been):</td>
<td>(Sethi and King, 1994) (Ellsworth and Ellsworth, 1994) (Ng et al., 1998)</td>
</tr>
</tbody>
</table>

**Operational**

<table>
<thead>
<tr>
<th><strong>DIMENSION</strong></th>
<th>Measures</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion Rate</td>
<td>The conversion rate of my company’s e-commerce is:</td>
<td>(Gurley, 2000)</td>
</tr>
<tr>
<td>Hit</td>
<td>The number of visitors visiting a site.</td>
<td>(Rose et al., 1999)</td>
</tr>
<tr>
<td>Page View</td>
<td>The number of pages visitors visit over a given period.</td>
<td>(Kroll, 2000)</td>
</tr>
<tr>
<td>Stickiness</td>
<td>The length of time visitors remain on a site.</td>
<td>(Kroll, 2000)</td>
</tr>
</tbody>
</table>
ELECTRONIC COMMERCE SUCCESS: DESCRIPTION OF THE KEY FACTORS

This section describes the factors affecting electronic commerce success.

Internal Driver

The internal driver is defined as perceived/expected benefits in using e-commerce. This factor will have positive impact on e-commerce success. Internal driver is reflected by the following sub-factors.

Cost Leadership

Literature shows that electronic commerce can reduce the costs associated with the information processing needed to perform the company’s primary process (Auger and Gallaugher, 1997; Benjamin and Wigand, 1995; Grover and Ramanlal, 1999; Malone et al., 1987; Ng et al., 1998; Poon and SWATMAN, 1999; Venkatraman, 2000; Wigand, 1997). This cost saving can be attained by using net-based catalogues, automatic credit card authorization and minimizing human error (Auger and Gallaugher, 1997). Chan & SWATMAN (2000) demonstrate that electronic commerce can reduce the inventory cost. The presence of electronic commerce reduces the layers of intermediaries that in tum reduce the distribution cost (Benjamin and Wigand, 1995; Ghosh, 1998; Ng et al., 1998; Riggins, 1999). Therefore, e-commerce is extra channel to distribute products – even in some cases, bypassing existing channels. Some authors argue that e-commerce is a low cost marketing medium since it enables firms to disseminate information regarding products and services globally at minimum cost (Auger and Gallaugher, 1997; Nath et al., 1998; Poon and SWATMAN, 1999; Strader and Shaw, 1997).

Reputation

E-commerce is suggested as having the ability to increase company’s reputation (Auger and Gallaugher, 1997; DE’ and Mathew, 1999; Nath et al., 1998; Poon and SWATMAN, 1998). This is even truer for larger businesses than smaller ones (Auger and Gallaugher, 1997). A study by Nath et al. (1998) reveal that the presence of an organization on the Internet may be triggered by the like action of their competitors. It might be considered that the company’s image will be undermined if it does not follow a competitors’ action.

Market

The Internet has opened new opportunities to access a broader market. Electronic commerce can help firms to sell products and services to an overseas market more easily (Nath et al., 1998; Riggins, 1999). Furthermore, Auger and Gallaugher (1997) reveal that Internet consumers are more affluent and educated than the average people. Indeed, they are a potential target market for particular products and services such as computer hardware and software, insurance, and banking. Also, e-commerce allows firms to ‘learn’ about their consumers’ preference when tracking visits to particular web sites. Often, consumers and visitors are not aware that they are under ‘surveillance’ and that their actions can be tracked. In addition, information collected using these techniques can be used to conduct market research (Auger and Gallaugher, 1997; Ng et al., 1998; Poon and SWATMAN, 1999).

Business Entry

It is considered that e-commerce has a low barrier to entry even for small businesses (Nath et al., 1998). Since there is no single party that can claim to be the owner of the Internet, it is open to anybody.
Internal Impediments

‘Internal impediment’ is defined as perceived constraint or likely constraint in using e-commerce. This factor will have negative impact on e-commerce success. Internal impediment is reflected by the following sub-factors.

Finance
The Internet is believed to be able to deliver goods and services more cheaply. This provokes some people to seek bargains on the Internet. However, this phenomenon does not necessarily mean more profit for the businesses concerned. While the number of transactions might go up on one hand, on the other, there could be a decrease in profit margin per transaction (Benjamin and Wigand, 1995). Another financial concern regarding the implementation of electronic commerce is the total cost of ownership (De' and Mathew, 1999; Nath et al., 1998; Saunders, 2000) such as set-up costs, connection costs, hardware costs and maintenance costs, among others. The total amount of costs together with unpredictable results may result in barriers to embrace e-commerce.

Risks
Kalakota and Whinston (1996) define security threat as “a circumstance, condition or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service, and/or fraud, waste and abuse.” Online businesses have certain security risks, such as viruses and hackers, due to the presence of a web server on their sites (Saunders, 2000). Further risk factors include the fact that the web-based databases might be copied, stolen, altered or destroyed by unauthorized users. The results might range from spoilt reputation to serious damage, even loss of a whole database (Saunders, 2000). Although many techniques, such as a firewall, can be used to protect the online database, the risks are still there since hackers will always attempt to find the security loopholes. Indeed, the real threat often exists within the business boundaries rather than from external sources (Rose et al., 1999).

Another impediment is that online businesses often find it difficult to monitor the use of the web site (Auger and Gallaugher, 1997). Although statistics from the visitors who log on to the website may help, a lot of visitors’ information remains unknown. Some companies require registration procedures before someone is granted an authorization to visit the web site and require that cookies be placed in the user’s computer. This mechanism allows the company to analyze the visitor’s pattern of use.

Nath et al. (1998) demonstrated that legal issues are an important consideration in conducting online business. A subsequent study by PricewaterhouseCoopers (1999) validates these findings. There are many questions regarding legal and liability issues. The enforceability of cyber law, legal jurisdiction, intellectual property rights and electronic evidence validity are some of these concerns (PricewaterhouseCoopers, 1999).

Expertise
Electronic commerce involves some areas of expertise such as the web developer, the content provider and customer service (Nath et al., 1998). The market need for people with these skills is quite high. Therefore, it is not an easy task and could be expensive to acquire and employ these people internally. Outsourcing, therefore, then becomes a possible answer to such problems.
External Driver

The external driver is defined as perceived/expected benefits to the external parties as a result from the company using e-commerce. This factor will have positive impact on e-commerce success. External driver is reflected by the following sub-factors.

Product Pricing

Theory suggests that online shops might be able to deliver better value for money on products and services than retail shops due to cost savings. Strader and Shaw (1997) argue that the presence of an electronic market in regard to particular products and/or services such as, books, music and airline tickets, has reduced the likelihood of consumers being overcharged due to limited information regarding other prices. This notion is supported by their subsequent study (Strader and Shaw, 1999). Additionally, Brynjolfsson and Smith (2000) also found that Internet prices are lower than retail outlet prices depending on the products’ cost structures and product types. However, this is not always the case. According to Palmer (1997), although the mean web store price is the lowest, price differences between a web store and other formats such as catalogue and cable TV are not significant.

Time Spent

One benefit of electronic commerce for consumers is time saving (Lynch and Lundquist, 1996). Kalakota and Whinston (1997) use ‘time compression’ as an expression to illustrate the capability of electronic commerce in shortening the business cycle. As such, time required in certain processes of product purchasing, including order time, processing time, queuing time and payment time could be reduced considerably. In doing so, many web sites are offering facilities, for instance online catalogues, shopping carts and online payments. For particular products such as software, these web sites are often able to deliver the product online (Riggins, 1999).

Convenience

For some people, doing transactions online is considered more convenient than at the ‘bricks and mortar’ shop due to certain factors including flexibility of business hours. Electronic commerce allows businesses to open their virtual outlets 24 hours x 7 days a week (Saunders, 2000), so that consumers can ‘go shopping’ at their convenience. Furthermore, some online businesses offer online payment mechanisms using credit cards. However, it is recognized that many people are concerned about the use of credit cards in online payment. Therefore financial transaction systems to overcome this problem have been developed, for instance by using ‘internet payment systems’ (Shon and Swatman, 1998). Another e-commerce convenience is the possibility of delivering streamlined transactions as well as personalized service (De’ and Mathew, 1999; Ghosh, 1998; Venkatraman, 2000). Customers can accomplish the transactions simply in one click. The need for repeated information and multiple forms can be minimized using ‘software agents’ that automate tasks (Riggins, 1999).

External Relationship

The presence of electronic commerce can lead to better and easier interaction with customers as well as suppliers (Ghosh, 1998; PricewaterhouseCoopers, 1999). Customer service functions can benefit from the interactive nature of web-based applications that facilitate customer feedback and enquiries through various means, for example e-mail and online survey (Auger and Gallowher, 1997; Riggins, 1999). To give such easy, 24 hours-a-day availability, with the possibility of quick response, online businesses may offer an online help desk - such as “FAQ” facility - to provide answers to the customers’ enquiries with less direct human involvement. An online survey by Pricewaterhouse Coopers (1999) revealed that most significant potential benefit of electronic commerce realized by small and medium enterprises (SMEs) is customer-focused service and information exchange. The study suggests that there is growing awareness of the possibilities of enhanced and more efficient customer-supplier relationship (B2B) among SMEs.

External Impediment

The external impediment is defined as perceived/expected impediments faced or likely to be faced by external parties in dealing with the company using e-commerce. This factor will have negative impact on e-commerce success. External impediment is reflected by the following factors.
Customer’s Expense

To be able to participate in an e-market, consumers have to get access to the Internet. While some consumers may use free access in the office or at school, others have to pay an Internet connection fee and telephone charges which vary among service providers. Strader and Shaw (1999), who named these costs ‘market costs’, stated that in an e-market consumers have market costs that they do not pay in the ‘bricks and mortar’ market. In addition, they argued that the extent to which these costs can be minimized would determine the choice between e-market and traditional market. A similar view was presented by Keeney (1999) who addressed the role of ‘value proposition’ – which includes the benefits and costs of ordering product online – in influencing the means of purchasing products and/or services.

Delivery Time

Compared to other retail formats, the online store seems to lag behind in terms of the deliveries of products and services (Palmer, 1997). Most products cannot be delivered immediately with the exception of digital products such as software, which can be downloaded and used almost instantly. Hence, to compete with retail shops or other formats, online businesses have to minimize the delivery time.

Transaction Risks

Undoubtedly, many people are reluctant to shop online due to ‘perceived’ security risks (Auger and Gallaugher, 1997; Furnell and Karweni, 1999). The Internet is often seen as an unsecured place to conduct business transactions. When transaction data is sent through the Internet, there is always a chance that someone – wherever he or she is – will eavesdrop and intercept that information to use it for his or her own interests (Nath et al., 1998). Credit card fraud is a classical example of this kind. It is argued that such problems mostly tend to be a managerial rather than a technological one (Rose et al., 1999). Another risk that may hinder B2C electronic commerce is privacy. The challenge is to convince customers that their information details are safeguarded, strictly confidential and will only be used for delivering superior value to them (Venkatraman, 2000). Further, the cyber privacy intrusion in the form of unsolicited e-mail and the use of ‘cookies’ to track the users behavior may be seen by many as a disincentive to the use of e-commerce.

Access

To attract visitors interest, web sites often use high-resolution graphics, video and audio streaming, which are usually large files. Therefore, a high-speed Internet access is required, which unfortunately is not always easy to obtain (Auger and Gallaugher, 1997). Otherwise, web site presentation might be slow, delayed and disrupted leading to visitors’ dissatisfaction. Indeed, Rose et al. (1999) argue technological impediment is not merely a matter of file size. It also pertains to the nodes’ configuration technology, the infrastructure of the network as well as bandwidth connection.
The proposed analytical model, as presented in Figure 1, is developed in Structural Equation Modeling (SEM) framework (Chin 1998a). It is suggested that the latent variables (first and second order) are reflective in nature (Barclay et al., 1995; Chin, 1998a; Chin, 1998b). The measures (see Table 3) are assumed to produce the first order latent variables (LVs) and these first order LVs in turn influence the second order LVs (see Figure 1).

In terms of the independent variable, there are 15 first order LVs obtained from prior studies and 4 second order LVs that were designed for this particular study. The second order LV, ‘internal driver’, includes the following first order LVs – cost leadership, reputation, market and business entry. Then, the second order LV ‘internal impediment’ contains first order LVs such as financial, risk and expertise. Next, the second order ‘external driver’ includes first order LVs as follows: product pricing, time spent, convenience, and external relationship. Finally, the second order ‘external impediment’ comprises first order LVs: customer’s expense, delivery time, transaction risk and access. The dependent variable in this model is ‘electronic commerce success’ which is measured by constructs, ‘competitive advantage’, ‘firm’s goal’, ‘conversion rate’, ‘page view’, ‘stickiness’ and ‘hit’ (see section 2 and Table 3).

Although there are some other multivariate analytical tools, the PLS type of Structural Equation Modeling is considered as suitable for the current study for the following reasons. First, the PLS allows the minimization of demand on measurement scales and sample size (Barclay et al., 1995; Chin, 1998b; Fornell and Bookstein, 1982); second, multivariate normality is not required (Barclay et al., 1995; Fornell and Bookstein, 1982); third, it is appropriate for use in the early theoretical development (Chin, 1998a; Fornell and Bookstein, 1982). Finally, compared to the first generation multivariate techniques such as regression, the PLS gives the researcher greater flexibility to play between theory and data (Chin, 1998b).
CONCLUSIONS AND FUTURE WORK

To evaluate the success of electronic commerce, businesses need metrics. Past studies demonstrate the extensive use of operational-quantitative measures such as the hit, the page view, the stickiness and the more recently, conversion rate. These computer-reported measures are considered as more objective, since they do not rely on individual perception. Additionally, to be comprehensive, the framework also incorporates strategic-qualitative measures gleaned from the IT field. These measures capture the impact of electronic commerce on the businesses’ goal attainment and competitive advantage. The literature also suggests some key factors that affect the performance of electronic commerce. Based on the direction of impact, the framework differentiates these factors into driving and impeding factors. These factors are then differentiated according to their contribution to the success of electronic commerce and according to the locus of impact. As an attempt to test the framework, the current study proposes to use PLS type of Structural Equation Modeling.

We have just finished a comprehensive survey of top Australian organizations based on the model of Figure 1. The data is being analyzed currently. The initial results indicate that both internal and external “drivers” significantly impact the e-commerce success, while the impacts of internal and external “impediments” on e-commerce success are not significant. This initial results support the popular belief that organizations adopt e-commerce primarily based on what “benefits” e-commerce can provide, rather than the associated “costs” of e-commerce. Our literature review (see section 2.1) also revealed that most of the prior research dealt with the “benefits” of e-commerce than the “costs”.

The model validation and full results will be subject of our future paper.
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Developing e-learning environments that support knowledge construction in higher education

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ABSTRACT

Much of the conventional development of Web-based learning environments the creation of electronic forms of existing print-based materials. In such instances the Web-based courses have tended to display limited evidence of an underpinning learning design and varying degrees of use of the opportunities and affordances of the new technologies. This paper provides an overview of instructional design principles that can guide the creation of Web-based learning materials that support learner engagement and knowledge construction. The paper describes the attributes of constructivist learning settings and provides some examples of explicit learning designs that can be applied in the design of Web-based learning environments. It describes strategies that are currently underway that are looking to provide ways to mainstream effective Web-based learning designs.

Keywords: instructional design, on-line, e-learning, higher education, constructivist

INTRODUCTION

The jury appears to still be out in relation to some of the benefits to higher education of contemporary e-learning projects and activities. E-learning has been mooted as the solution to many of the problems that face institutions of higher education. Many writers have argued the use of e-learning to attract new markets and new students, others have argued its capacity to increase levels of equity and access for existing students, while others see the new technologies as capable of reducing the costs of delivery of programs and courses. While many of these claims and potentials have yet to be verified the one thing we have learned from our activities in this domain is that e-learning, when done well, can improve learning and deliver enhanced learning outcomes. The intention of this paper is to explore strategies that can be used to assist in the design of effective e-learning environments. In essence, it attempts to provide a blueprint for design which academics can follow when they wish to create effective e-learning environments.

INSTRUCTIONAL DESIGN FOR WEB-BASED LEARNING

In a previous paper, I described a framework for designing online learning settings (Table 1). The framework comprises three interconnecting elements which are presented as critical components for the design of learning settings. In particular, the framework highlights various distinctions between the elements involved in the design of online learning settings (Oliver, 1999).
Table 1: Framework describing critical elements of online learning settings

<table>
<thead>
<tr>
<th>learning design elements</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>learning tasks</td>
<td>The activities, problems, interactions used to engage the learners and on which learning is based</td>
</tr>
<tr>
<td>learning resources</td>
<td>The content, information and resources with which the learners interact and upon which learning is based</td>
</tr>
<tr>
<td>learning supports</td>
<td>The scaffolds, structures, encouragements, motivations, assistances and connections used to support learning</td>
</tr>
</tbody>
</table>

The framework provides a means to identify the various elements within learning settings and suggests emphases which can be made in the instructional design process. Contemporary learning theories posit that the forms of learning design most appropriate to higher education are those based on constructivist learning principles. The above framework takes on particular and discrete forms when applied this way.

LEARNING TASKS

The learning activities in technology-based environments play a fundamental role in determining learning outcomes (Wild & Quinn, 1997). They determine how the learners will engage with the course materials and the forms of knowledge construction that will take place. Contemporary thinking suggests that the activities must be active and engaging (eg. Wild & Quinn, 1997). They need to engender cooperative and collaborative activities among the cohort and in doing so must provide opportunities for reflection and articulation. The activities must provide the purpose and the context for learners to deal with the content and information (Duffy & Cunningham, 1996).

A synthesis of the pedagogical features for constructivist learning in on-line settings suggests the need for instructional design approaches which promote learning outcomes through learning processes and strategies employing various modes of communication (eg. Jonassen & Tessmer, 1996; Collis, 1998). Fundamental to the notion of knowledge construction is an active role for the learner in which there is encouragement and reason to act independently and in a self-directed fashion. Characteristic of these approaches to learning are settings and activities which see learners assuming much of the responsibility for themselves in terms of what is learned and how it is learned (eg. Duffy & Cunningham, 1996).

LEARNING RESOURCES

Choosing and developing content for flexible technology-based learning is seen by many teachers as the most important step in creating on-line learning environments. This is reflected in the resulting materials which often have a content-focus (eg. Dehoney & Reeves, 1998). It is sometimes estimated that on-line teachers spend 90% of their planning and development creating content and on-line learning resources. Contemporary thinking suggests that the content can, and should, assume a far lesser role in the design process. In constructivist learning environments learners need to be exposed to content that provides them with perspectives from a multitude of sources (eg. Herrington & Oliver, 1995). The materials need not all be on-line. The use of conventional materials along with electronic sources can provide the diversity often required. Previously designers created course materials where the content was rigidly organised and presented to the learners in a strict sequence. Today it is recognised that learners need to be able to access resources in a variety of ways and the absolute strictness and rigidity should be lessened (eg. Lebow, 1993).
Duschatel (1997) argues that content also needs to be chosen in a fashion which provides authentic examples and contexts. This argument is very much in line with situated learning principles. The move to outcomes-based and competency-based education is a reflection of this form of thinking. In such instances, the content is presented as a means to an end rather than an end in itself and it is the learner who must make most of the choices about which material to use and how to use it. There are many ways in which these principles and ideas can be implemented in on-line settings. Perhaps the best strategy to deal with this is to consider content as a resource for learning rather than the focus of learning.

LEARNING SUPPORTS

The third and final critical design element from the framework is that of learning supports. Flexible and on-line learning environments need learning supports to be designed as integral parts of the learning process. The support is necessary to guide learners and to provide a feedback mechanism which is responsive and sensitive to their individual needs (eg. McLoughlin & Oliver, 1998). In distance education contexts, learner support is a term that often embraces more extensive mechanisms such as academic support, library support and counseling. In this paper, the term is used in a much narrower context and limited to aspects of the on-line learning environment alone.

A number of writers have developed strong frameworks to describe the ideal forms of support required for on-line learning environment and in each case, there is usually a strong argument made for an active and involved teacher (eg. Laurillard, 1993). The role of the teacher however, tends to be defined as that of a coach and facilitator in place of the more didactic style often assumed. In contemporary settings, this form of learning support is called scaffolding in recognition of the way in which it helps to build knowledge and is then removed as the knowledge construction occurs.

APPROACHES TO INSTRUCTIONAL DESIGN

The framework described above discusses the various roles of each of the three elements. Often in the design process, designers emphasise one of the elements over others and in this way create an environment with particular attributes. Figure 1 below suggests differences in the nature of learning environments when one or more of the elements is emphasised in the design process.

![Figure 1: Instructional design emphases](image-url)
Resource-based learning. In the past, many forms of online learning setting have been based on the delivery of online content. When the online environment is based on online content delivery, the resulting products are resource-based environments. These environments are characterised by an emphasis on online content and typically tend not to make the most of the opportunities afforded by the online technologies. Many writers are critical of such online learning settings for the narrowness of the instructional approaches they use.

Teacher-centred learning. More contemporary online learning settings make strong use of the communications facilities of the Web. For example, many teachers support their online courses with discussion fora and online communications. In this way they create roles for themselves as supports for learning. When Web-based learning is used as a support for classroom learning, the prominence of the teacher role leads to a teacher-centred approach. In remote learning settings, use of the online facilities in supportive ways creates this form of environment.

Task-centred learning. The third type of learning suggested by the framework derives from settings where the learning activities are the underpinning elements. Task-based approaches stem from the use of learning activities as the contexts and anchors for student learning. In such instances students work in various ways to complete tasks, inquiries and projects etc. with access to resources and with forms of online support. In this paper I argue that task-based learning provides the best opportunities for learning environments that support active learning and knowledge construction.

CONSTRUCTIVIST LEARNING SETTINGS

The emergence of the new learning technologies appears to have coincided with a growing awareness and recognition of alternative theories for learning, theories that suggest many problems and inefficiencies with conventional forms of teaching. The theories of learning that hold the greatest sway today are those based on constructivist principles (eg. Duffy & Cunningham, 1996). These principles posit that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts. In constructivist theories, social interactions are seen to play a critical role in the processes of learning and cognition (eg. Vygotsky, 1978).

The strengths of constructivism lie in its emphasis on learning as a process of personal understanding and meaning making which is active and interpretative. In this domain learning is viewed as the construction of meaning rather than as the memorisation of facts (eg. Lebow, 1993; Jonassen & Reeves, 1996). Technology-based approaches to learning provide many opportunities for constructivist learning through their provision and support for resource-based, student centred settings and by enabling learning to be related to context and to practice (eg. Berge, 1998; Barron, 1998).

Many writers have in the past provided guidance for the design of constructivist learning settings by articulating the underpinning characteristics. For example, Cunningham, Duffy & Knuth (1993) argue that constructivist learning environments are characterised by seven pedagogical goals. They suggest that constructivist learning settings are those which concurrently:

- provide experience in the knowledge construction process;
- provide experience in and appreciation for, multiple perspectives;
- embed learning in realistic and relevant contexts;
- encourage ownership and voice in the learning process;
- embed learning in social experience;
- encourage the use of multiple modes of representation;
- encourage self-awareness in the knowledge construction process.
Lebow (1993) presents five principles that he considers are needed to integrate the affective and cognitive domains of learning in ways that support constructivist principles of learning. He argues the need for learning environments to:

- maintain a buffer between the learner and the potentially damaging effects of instructional practices;
- provide a context for learning that supports both autonomy and relatedness;
- embed the reasons for learning into the learning activity itself;
- support self-regulated learning by promoting skills and attitudes that enable the learner to assume increasing responsibility for the developmental restructuring process;
- strengthen the learner's tendency to engage in intentional learning processes, especially by encouraging the strategic exploration of errors.

Savery & Duffy (1995) argue that there are four principles that necessarily underpin learning in constructivist settings:

- learning is an active and engaged process;
- learning is a process of constructing knowledge;
- learners function at a metacognitive level;
- learning involves social negotiation;

Grabinger (1996) provides a succinct list of the assumptions of learning that are aligned with contemporary constructivist views:

- People transfer learning with difficulty needing both content and context learning.
- Learners are active constructors of knowledge.
- Learning is cognitive and in a constant state of growth and evolution.
- Learners bring their own needs and experiences to learning situations.
- Skills and knowledge are best acquired within realistic contexts.
- Assessment must take more realistic and holistic forms.

The descriptions which authors provide of the elements required for constructivist learning settings can help designers to understand the forms of learning activity which are required but often fail to provide adequate guidance for the actual learning designs that can encapsulate such principles in cohesive and supportive ways. Hannafin, Hall, Land Hill (1994) suggest that appropriate forms of learning settings are what they call open-ended learning environments. These are characterised by learner engagement in cognitively complex tasks involving such activities as problem solving, critical thinking, collaboration and self-regulation.

There are however a number of discrete learning designs that support constructivist learning and whose forms can provide designers with guidance and structure in the design of actual constructivist learning settings. In the literature many of these designs remain ill-structured in their definitions and descriptions which can limit teachers in their choice and use of them.
CONSTRUCTIVIST LEARNING DESIGNS

When these ideas are put into practice, the forms of learning setting that result are similar in many respects and quite different to conventional settings. The designs tend to be based on forms of learning that are based on learners undertaking various forms of activity that are open-ended and student-centred. The forms of environment tend to be those that require learners to work with others and to share the results of their work and to reflect on the outcomes. They tend to be settings where there are no fixed resources or content to be learned and where the emphasis is on learning how rather than learning about. There are a number of discrete learning designs that accommodate these needs and some of these are discussed below.

a. **Problem-based learning** (PBL) is a learning design that found popularity in the mid 1980s in medical schools as an alternative to traditional forms of learning in this domain. Barrows (1992) describes a problem based setting where students work in small groups under the guidance of a facilitator in a problem-based setting where they are required to diagnose a patient’s medical condition and to provide a rationale for their diagnosis and treatment. PBL involves presenting students with a real-life problem immersed in a context which is relevant to professional practice. Problem-based learning designs involve complex problems which provide a stimulus for learning. They provide students with the opportunity to immerse themselves into a context which requires more than memorisation and understanding of concepts and challenge them to apply their knowledge to determine the best outcome.

In PBL settings students apply their conceptual knowledge as well as processes and effective action learnt in solving the problem. Problem-based learning usually incorporates cooperative learning groups. Students work cooperatively in small groups identifying their prior knowledge and what they need to know to effectively solve the problem. Problems did not encourage simple, lower level solutions but demand that students pursue new knowledge through the process of solving the problem. The application of knowledge and skills is essential during the process of problem solving. The teacher’s role is to facilitate a positive, encouraging cooperative learning environment and provide scaffolding at crucial times, as determined by the dynamic process of solving the problem.

b. **Case-based learning** is a form of problem-based learning but with unique characteristics. In case-based learning, students typically work through a problem setting which is usually a realistic case relevant to their course (medicine, business, etc). Students work through the case, either collaboratively or individually, and make decisions as to what would be the best course of action. A case is an abstract of an event and interpretations of experiences. It can either be a previously encountered and solved problem, or a typical way of solving a problem.

The characteristic feature of this type of learning activity is case-based reasoning. Case-based reasoning is a problem solving paradigm which utilizes the specific knowledge of previous experiences within concrete problem situations such as cases. A new problem is solved by finding a similar past case, and applying its solution to the new problem situation. Cases can have several components. If each component of the case is interpreted correctly the more useful it will be when it is necessary for the student to recall and apply similar knowledge and processes to another case (Kolodner & Guzdial, 2000).

c. **Project-based learning** engages students in the process of designing and creating products that meet authentic needs. It can focus on the central concepts and principles of a discipline through involving students in problem-solving investigations. Project-based learning lends itself to cooperative learning environments which enable students to discuss, explore, test ideas and concepts supported by a team environment. Even so, projects can be worked on autonomously. Project-based learning environments are considered authentic in nature and provide a learning environment which stimulates and encourages students to construct their own knowledge and pursue their own interests resulting in the creation of realistic products (Guzdial, 2000).
**d. Inquiry-based learning** describes a learning design where students are faced with an open-ended task for which they must formulate investigative questions, obtain factual information, and then build the knowledge that enables them to answer the original question. The form of learning is a hybrid of problem-based learning with its own idiosyncratic features. Students are often required to observe and question, present explanations, devise and conduct tests to test their theories; analyse data; draw conclusions; or design and build models. Inquiry-based learning emphasises research, critical thinking and multi-disciplined study to achieve course outcomes. Inquiry-based learning is sometimes discussed in conjunction with problem-based learning. Jakes, Pennington & Knodle (2001) describe inquiry-based learning as a process where students formulate questions or the teacher provides questions to stimulate investigative processes to obtain information to help build knowledge to effectively determine a solution. Typically students are aided with questions or scaffolds provided by the teacher or other students.

Inquiry-based learning differs from problem-based learning by virtue of its use of a greater range of learning methods, high levels of teacher support and scaffolding, and an emphasis on an interdisciplinary approach to learning, critical thinking as well as students assuming responsibility for their own learning (Magnussen, Ishida & Itano, 2000). Inquiry-based learning can involve other forms of learning design including discussions, group exercises and role plays. The strategy makes strong use of student interactions, their previous knowledge and life experiences (Cerny, Amundson, Mueller & Waldron, 1996).

**e. Role playing** is a learning activity where students assume characters within a chosen context and carry out roles in the conduct of a predetermined scenario. Role playing is often used in educational contexts as a means to develop the affective components of a curriculum, for example students' beliefs and attitudes. In many business courses, role playing is used in such areas as counselling, negotiation training and learning about ethics (eg. Glass, 1999). Some instances of role playing take the form of games and are often referred to as simulations. In the context of this paper, we are principally concerned with the less structured forms of role playing.

Role playing is an open-ended learning environment and can involve the same high levels of learner activity and inquiry as other settings described earlier. Role plays are usually based around problem settings and in themselves tend to be problem-solving activities. Role plays are set within specific contexts and tend to follow a phased approach with learning occurring across a number of phases (Chesler and Fox, 1966).

**IMPLICATIONS FOR MAINSTREAM TEACHING**

The learning designs that I have described above are discrete and recognisable entities. They represent forms for the design on any type of learning environment but are very well supported when used in online settings. There are many academics and teachers who are finding very effective ways to apply these design strategies in their classes in higher education. But for many the learning design is unknown and its potential for application in their classroom teaching is quite distant.

There are now a number of projects which are underway to make it possible for teachers to employ these forms of learning design in their own classes through online technologies. One particular project in which I am involved is an Australian Universities Teaching Committee Project which is exploring ways to create templates and generic designs for learning environments with learning designs of the forms I have described here. Many other agencies are now looking for ways to create reusable forms of learning designs and learning resources to foster and encourage the development of sustainable and effective online learning settings. Much of the research and development work in online learning is exploring issues associated with creating the means for mainstream teachers to seamlessly integrate new technologies in meaningful ways into the learning programs.
SUMMARY AND CONCLUSIONS

This paper has discussed the nature of constructivist online learning environments and has presented a synthesis of contemporary thinking describing the attributes of settings that support knowledge construction. The paper has presented a model to inform the design of constructivist online learning settings and argues the needs for learning that is task-based and centred on open-ended and ill-structured activities.

A number of learning designs have been presented that have been found to support constructivist learning settings. These learning designs are being used more and more as the basis of the design for online learning. They provide a structure and framework for designers to follow which encourages the selection and creation of meaningful tasks as the basis for student activity. At the same time the various designs support the notion of authenticity in the tasks in terms of the nature of the tasks and the contexts in which they are set.

Whereas in the past we have seen the proliferation of Web-based learning settings that have consisted mainly of on-line content and online interactions between teachers and students, we are now seeing increasing application of the forms of learning design described in this paper. Much of the research in instructional technologies today is focusing on exploring ways to refine and modify these settings to discover the optimal forms of learning activity and engagement to support the transfer of learning from the classroom setting to the workplace or the setting where its intended use will be.

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Online Portfolio Assessment in Information Systems

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ABSTRACT

The paper explores how portfolio-based assessment, particularly its online forms, can address some of the challenges presented by new trends in tertiary education in fast changing subject areas such as Information Systems.

Keywords: Information Systems, Assessment, Portfolios, Online

INTRODUCTION

The problem: How can university assessment methods be developed to meet new challenges and address contemporary assessment problems in the field of Information Systems?

Six trends in tertiary education indicate that university assessment methods need to be reviewed:

Increasing focus on 'outcomes-based' assessment of professional skills. This is strongly evident in Australia, the US and the UK, and echoing 'competency-based' assessment in other areas of education (see, for example, Australian Computer Society, 2001a, Australian Nursing Council Inc., 2000, ANTA/AVCC, 2000).

Increasing emphasis on graduate attributes (DETYA, 2001, DETYA, 1999) creating tension between existing assessment structures and those appropriate to graduate attributes.

High rate of change of knowledge especially in fields such as Information Systems (IS), Information Technology (IT), and some Natural Sciences (Australian Computer Society, 2001a).

Increased emphasis on employability as an outcome of university education (DETYA, 1999, DETYA, 2001).

Increasing problems with plagiarism and fraud fuelled by the ease of computer based editing and copying of Internet sources into assessment submissions (Terrell and May, 2001).

Pressure to improve assessment quality by improving the accuracy, focus and feedback of assessment processes (DETYA, 1999, Cooper, 1999).

Minimising problems associated with equity issues by making assessment equitable for all students (Cooper, 1999).

Disintegration of education processes and assessment because of increasing tendencies for units to be delivered by partner institutions, and marking to be outsourced (see, for example, Technology and Industry Advisory Council, 2000, Bradley, 2000).
Outcomes-based assessment: Increased focus on outcomes-based assessment changes the emphasis towards 'demonstrating the application of a body of knowledge' rather than 'knowing about' a body of knowledge. Different forms of assessment are needed for educational processes that focus on the skills and the practical application of knowledge in fast changing situations. Traditional assessment is less appropriate for this purpose because it was originally developed for assessment in:

- Discipline areas in which the rate of change of knowledge is slow.
- Societies in which the rate of social change is slow.
- Situations in which professional skills are acquired elsewhere.

The trend towards outcomes-based assessment is found throughout education: in the university systems (Graduate Attributes) (DETYA, 1999, p 16, DETYA, 2001, p 32), in the school education system (Curriculum Council, 1998), and in the professions (see, for example, Australian Computer Society, 2001a, Australian Nursing Council Inc., 2000).

Graduate attributes: By definition, graduate attributes are skills that students have at graduation. Assessment modalities for graduate attributes cannot easily be integrated with traditional unit assessment processes where courses are modularised and where modules can be taken in a variety of different sequences. There is tension between existing university assessment structures and assessment structures needed for the assessment of graduate attributes because generic skills assessment crosses unit boundaries and existing assessment processes are focused around topic-based units.

High rates of change: In fast changing professional disciplines, such as IS, it is unsatisfactory to assess ability through the demonstration of detailed knowledge of content likely to be obsolete soon. Professional institutions such as the Australian Computer Society (2001a) regard it is more important for students and practitioners to:

- Be able to demonstrate their understanding of fundamental concepts that underpin a discipline’s knowledge.
- Demonstrate their ability to learn and continually update their skills.

Assessment of these skills is not usually regarded as a strength of traditional assessment modalities, which assess students’ grasp of pre-defined topic information rather than their abilities to develop their knowledge and skills.

Employability: In fields of study in which knowledge becomes quickly obsolete, one-time mastery of a body of knowledge does not imply ongoing employability or continued professional competence (Australian Computer Society, 2001a). There is tension between education appropriate to a fast-changing knowledge situation, and the expectation that students completing a course should be immediately employable without further training. Pedagogically, it is complex but feasible to create educational processes that fulfil all these aims; helping students acquire a deep understanding of fundamental concepts, skills at life-long learning and continued professional development, and skills of immediate use in employment. Combining these educational processes presents assessment problems. These assessment problems are more easily resolved by portfolio-based assessment because the role of a portfolio as a 'container' allows the inclusion of different forms of evidence.

Plagiarism: There is increasing concern about levels of student plagiarism, especially in fields such as IS in which students have high levels of computer and Internet skills (Kearns, 2000). Portfolio-based assessment can assist in this situation by facilitating the triangulation of assessment. Traditional forms of assessment that do not co-locate individual assessments from different units do not offer a ready means for examiners to correlate standards across an individual student’s multiple assessment items.
Improving Assessment Quality: Assessment processes are becoming increasingly subject to quality assessment and quality assurance processes (DETYA, 1999, Kemp, 1999). Improving the quality of assessment depends on a direct and transparent relationship between the aims of education and practicalities of assessment. In addition, improving assessment quality requires sound moderation between and across units, courses and institutions.

Minimising problems associated with equity issues: The shift to tertiary mass education has resulted in culturally, educationally, and socially more diverse student populations (DETYA, 1999). This significant reduction in homogeneity increases the potential for equity issues in assessment. Minimising equity problems is an important aspect of choosing assessment methods. Portfolio-based assessment can resolve many of these equity issues (Cooper, 1999).

Disintegration of education processes and assessment: Trends towards commercialisation, modularisation and globalisation in education have led to courses and units being delivered by partner institutions, and through flexible delivery modes including external study or Internet-based study, and with marking processes often outsourced to junior staff or postgraduate students (Technology and Industry Advisory Council, 2000, Bradley, 2000). Each of these factors reinforces the problems of traditional assessment processes and reduces the possibility for appropriate, effective, efficient, equitable, high quality assessment suited to professional education in fast-changing knowledge areas.

This paper argues that the above factors point to the need to review assessment processes. It uses Cooper's (1999, 1997) six-step model of portfolio-based education to show how portfolio-based assessment offers benefits over traditional modes of assessment in addressing the assessment challenges raised by these factors. The paper explores the role of professional accreditation in IS assessment and then concludes by discussing how online portfolio-based assessment can address the above assessment challenges.

PORTFOLIO-BASED ASSESSMENT

Portfolio-based assessment is now well established as a valuable assessment tool (see, for example, Barrett, 2000c, Biggs and Tang, 1997, Cooper, 1997, Education Department of Western Australia, 2000a, Education Department of Western Australia, 2000b). Portfolio-based assessment is beneficial pedagogically because the format can encompass evidence from a wide variety of sources (Education Department of Western Australia, 2000b), it can help educators overcome many assessment difficulties, especially in relation to equity and moderation (Cooper, 1999, Cooper and Love, 2000), it provides a 'richer picture' of the student (Barrett, 2000c), portfolio-building actively involves students in the learning process (Bowie et al., 2000), and is valuable in supporting lifelong learning (ANTA/AVCC, 2000). For IS and IT related disciplines, online portfolios are especially appropriate (Bowie et al., 2000, Barrett, 2000c).

Cooper's (Cooper, 1999, Cooper, 1997) definition of a portfolio is:

Portfolio: Collection of evidence that demonstrates skills, achievements, learning or competencies.

Cooper's 'six step' portfolio building process is well established as a basis for planning and teaching outcome-based professional assessment in tertiary courses (see, for example, Cooper, 1997, Cooper, 1999, Cooper and Emden, 2000, Cooper et al., 1999, Cooper and Love, 2000). The six-step process ensures that portfolio-based assessment is applied in a purposive way that relates transparently and directly to predefined pedagogic processes and outcomes.
The portfolio-building process consists of:

Step 1: Identify the **areas of skills** that the student is intended to develop.

Step 2: From these skill areas, develop specific **learning outcomes** for the student to achieve.

Step 3: Identify appropriate **learning strategies** for the student to achieve their learning outcomes.

Step 4: Identify **performance indicators** that establish the student has achieved their learning outcomes, and indicate the evidence the student needs to collect.

Step 5: Collect **evidence** that demonstrates the student has met the performance indicators.

Step 6: Organise this evidence in a **portfolio** so assessors can easily understand how the evidence relates to each performance indicator.

Visually, the sequence is:

```
Skill areas
  Learning outcomes
    Learning strategies
      Performance indicators
        Evidence
          Organisation of the portfolio
```

Cooper (1999, 1997), copied with permission
The table below shows how the six step process might be applied in an IS context.

<table>
<thead>
<tr>
<th>Six Step Process</th>
<th>Information Systems Course Design Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill area</td>
<td>Core skill areas determined by the pedagogic aims of the course, ACS requirements, and graduate attributes</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Learning outcomes are either prescribed by the course outline, or individually negotiated with students after their level of expertise in each skill area</td>
</tr>
<tr>
<td>Learning Strategy</td>
<td>Learning strategies are suggested by lecturers, but ultimately the responsibility of each student</td>
</tr>
<tr>
<td>Performance indicators</td>
<td>Performance indicators are defined by course design, or discussed with students so that they understand how to make decisions about standards of performance relevant to key IS skills</td>
</tr>
<tr>
<td>Evidence</td>
<td>Students collect evidence of their skills and knowledge from a variety of sources including: marked assignments, references and testimonials, certified courses, external projects, employment</td>
</tr>
<tr>
<td>Organisation of portfolio</td>
<td>The portfolio is assembled and presented according to a predefined structure. This structure can be defined more or less completely. For example, it may consist of tables of contents, commentary relating evidence to performance indicators, and items of evidence. A more tightly defined portfolio schema might involve a rigid online template structure within which students enter evidence and explanations of the relationships of evidence to performance indicators. Background server-side processing then shapes how each portfolio is viewed by examiners online or in print.</td>
</tr>
</tbody>
</table>

Portfolios are either summative or formative, *summative* portfolios demonstrate learning outcomes while formative portfolios demonstrate learning processes. This paper focuses on summative portfolios, because professional accreditation such as that of the Australian Computer Society (ACS) is primarily concerned with final achievements rather than the students’ learning processes.

Summative portfolio-based assessment has three main forms (Barrett, 2000c, Cooper, 1999):

- The competency based portfolio,
- The negotiated learning portfolio
- The biographic profile, or record of achievement.

In the competency-based portfolio, course outlines specify the learning outcomes for a student. In the negotiated learning portfolio, students negotiate intended learning outcomes. Competency and negotiated learning based portfolios can be combined into a hybrid approach for which the lecturer stipulates some compulsory learning outcomes and allows students to define additional learning outcomes relevant to their personal interests and future career directions. The biographic portfolio or profile is an expanded Curriculum Vitae that is not generally sufficient for assessment purposes because it is not usually related to performance indicators and specified learning outcomes.

Most students do not enter university with the skills necessary to plan their professional development or satisfactorily organise a professional portfolio. Experience in other disciplines has shown it is necessary to teach students these skills. The six-step portfolio building process above was developed for this purpose. Within IS curricula, this process can be taught in whichever unit focuses on developing students’ lifelong learning skills to facilitate continued professional development.
Information Systems assessment & professional accreditation

In tertiary IS education in Australia, the Australian Computer Society (ACS) is a key body for accreditation of courses and individuals. The ACS emphasizes continuous professional development, and their accreditation of courses requires IS professionals to recognize their training needs and participate in devising suitable means of meeting those needs (Australian Computer Society, 2001a). They state that,

"Because knowledge about information technology is still expanding rapidly, it is important that IT professionals continue to learn throughout their careers. It should be both an employer and an employee expectation to undertake continuing education courses in various forms, either at academic institutions, through publicly available seminars and conferences, or the ACS certification scheme. IT professionals also should undertake studies in management or in the fields of application of IT that are relevant to their daily work, such as accountancy, business, or any other appropriate discipline."

As part of their university education, IS students should learn how to recognize their own training needs and how to satisfy them. The above statement from the ACS guidelines, acknowledges it is impossible for any undergraduate course to adequately prepare students for all possible IS/IT careers.

The ACS syllabus (Australian Computer Society, 2001b) identifies the following skills as fundamental in information fields. The ACS require that students must:

- "Understand the need for and the importance of information in an organisation"
- "Understand the need for data integrity and security and the means by which these may be obtained"
- "Understand the components which comprise the information technology infrastructure in the organisation"
- "Understand the processes involved in problem-solving and the methods used for developing computer-based Information Systems"
- "Understand the essential features of the hardware and software data management and data communications components of computer-based Information Systems"
- "Understand the ACS code of ethics as an example of such occurred required by professional society"

This demonstrates an explicit focus on generic fundamental skills that avoids assessing students' skills at using proprietary computer languages or applications because they are subject to rapid change.

The ACS approach aligns well with portfolio-based assessment because it provides a medium for students to collate evidence of fundamental skills over a wide variety of contexts. Students can organize their portfolios around mandatory areas such as those defined in the documentation of their courses and the syllabi of the ACS. They can choose additional skill areas, such as those outlined in the optional ACS examination syllabus, and graduate skills relevant to IS/IT in the graduate attributes list. If students undertake specific professional training during their degree, they may wish to include in their portfolio any relevant proprietary certification. Students may also choose to supplement their portfolio according to their personal interests or future career goals. This helps students to build skills to manage their own professional development. Online portfolio based assessment is very appropriate in developing the skills required for ongoing professional development such as that required by the ACS, because the medium provides an authentic assessment opportunity where students can demonstrate their skills (Barrett, 2000b).
Online portfolios

Online variants of portfolio-assessment offer several additional practical advantages to those of hardcopy portfolios (Barrett, 2000a, Cooper and Love, 2001) because they:

- Are easy to backup /store
- Have good portability
- Allow multiple simultaneous access by examiners
- Have good shelf life.
- Allow the ready inclusion of dynamic cross-referencing of documents
- Can include cross-referenced multi-media presentations
- Offer the means of automating many routine tasks undertaken by lecturers and admin staff.
- Open the way to automating several aspects of marking, initially in the areas of grammar and spelling.

ONLINE PORTFOLIOS & EQUITY

Online processes for creating and assessing portfolios depend on technology, and students’ technology skills. Potentially, these dependencies may have a significant and adverse affect on assessment quality by reducing equity. Access to technology to build online portfolios is not ubiquitous. In some cases, it is tied to the socioeconomic status of individuals and institutions. To reduce equity problems the portfolio format should be specified so as to avoid disadvantaging students because of lack of access to hardware or software. This minimises students being unfairly disadvantaged through limited access to more sophisticated software.

Barrett (2000a) separates electronic portfolios into different categories on the basis of the levels of skills, hardware and software needed. ‘Electronic’ portfolios, for Barrett, include ‘any electronic representation’ such as video and audiotapes, and are not necessarily computerised. Barrett’s categories are outdated by technology changes, but her approach is useful for categorising modes of online portfolio assessment. The categories provide the basis for choosing technology platforms and presentation specifications to minimise equity issues.

Most equity issues for online portfolio assessment that are caused by technological issues can be resolved by limiting the technologies that can be used to a common framework. This can be done, for example, by the use of online templates designed to work with a set of standardised hardware and software that is available to all students, and in which all students are trained. This limits the scope for more affluent students to gain assessment advantage through access to more sophisticated software.

ONLINE PORTFOLIOS & PLAGIARISM

Computed-aided plagiarism is an assessment problem for student work submitted in both paper-based and online formats where online access and computers are available (Kearns, 2000). Lecturers cannot easily address the plagiarism problems that the Internet presents using traditional approaches. Recent experience, anecdotal and reported, indicates plagiarism is a serious assessment concern (for example, Terrell and May, 2001). Suspicions about plagiarism undermine confidence in assessment procedures, and negatively affect the reputation of the examining institution. This provides pressure for cases of plagiarism to pass apparently undetected or be resolved without publicity, increasing the level of suspicion. New forms of addressing plagiarism are needed.

Assessment by online portfolios facilitates the detection of plagiarism. New technology means electronically submitted student work, especially structured submissions such as online portfolios, can be automatically scanned for plagiarism. Recently developed software from Glatt, iParadigm, IntegriGuard and others (IntegriGuard.com, 2001, iParadigms.com, 2001, Plagiarism.com, 2001) offers a means to test for plagiarism in electronically submitted documents. Glatt’s program, using cloze
theory and the uniqueness of each individual's writing 'fingerprint', claims to detect plagiarism where it would not have been detected by manual systems without producing 'false positives'. This is an important consideration given the seriousness of plagiarism. This process can be applied to hardcopy but is easier where documents are electronic. This offers a significant improvement in strategies for reducing plagiarism, and maintaining credibility in assessment processes.

ONLINE PORTFOLIOS AND FRAUD

In IT courses, the opportunities for fraud may represent a particular temptation for some students because they have access to equipment and expertise that facilitates fraud. It is easier to alter undetected an electronic copy of a certificate or electronic reference than to credibly alter an original hardcopy.

Tampering with electronic evidence is a serious issue. It falls under university misrepresentation regulations in the same way that applicants who lie about qualifications are subject to a summary dismissal if their lie is discovered. Fraud in evidence invalidates a portfolio in assessment terms, and should lead to severe penalties including possible exclusion from the university.

The triangulation facilitated by portfolio assessment offers some protection from assessment fraud where gross differences in skill level are evident. Currently, there are emerging standards in online certification of documentation. The main weakness that remains is in the processes of converting paper-based documentation into electronic form. In terms of quality assurance processes, one way addressing this issue is for students to sign a declaration that they have the original evidence on which electronic portfolio submission is based, and that they have not in any material way altered or edited certification, references or evidence provided by other people and included in the portfolio.

Server-based security is well developed and there are several fraud-hardened approaches to assessment certification possible. For example, external and associate examiners can enter marks or competency certification using web-based password protected forms that use secure server-side scripts to place an authenticated certificate in a student’s online portfolio container.

ONLINE PORTFOLIOS – GRADUATE ATTRIBUTES

Online portfolios offer an efficient means of demonstrating and assessing graduate attributes. Portfolio based assessment uses a combination of performance criteria and evidence. Graduate attributes provide an additional set of performance criteria and can be included in portfolio assessment processes in a similar way to other performance criteria. Up to final assessment, any evidence that a student collects to satisfy unit-based performance indicators may be also presented as evidence that they possess graduate attributes. This removes the need for a separate graduate assessment mechanism and minimises the need for students to prove that they posses particular graduate attributes.

SUMMARY

This paper presents a strong argument for the inclusion of online portfolio-based assessment in IS education (alongside other assessment strategies) to resolve identified challenges due to changes in tertiary education environments. Online portfolio-based assessment offers efficient and effective ways to include graduate attributes, quality assurance processes, and professional certification. It offers the basis for addressing equity issues and controlling plagiarism and fraud, it provides students with an authentic opportunity to demonstrate their ability to use software and hardware on a real task, perhaps most importantly, it help students to develop skills that enable them to plan and documents their own continued professional development. This skill is essential to IS students as future professionals.

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Jurisdiction: How does it affect e-commerce - strategies for virtual organisations

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ABSTRACT

The long term success of business to consumer e-commerce depends, in large part, on the existence of satisfactory supporting legal infrastructures coupled with the implementation by virtual organisations of appropriate strategies that will achieve optimum business protection, consumer trust and legal compliance. The concept known as 'jurisdiction' is gaining in significance in the world of e-commerce. The purpose of this paper is to explain why it is that jurisdiction impacts on all the players involved in e-commerce and to explore strategies that could be implemented by virtual organisations that might eliminate, or at least reduce, the associated risks.

INTRODUCTION

Public discussions of electronic commerce...centers around global electronic commerce as a fait accompli, a done deal...But the realities of the situation...are far different from the public perception. Many serious issues are unresolved, fundamental issues such as legal and political infrastructure... A corrective is...needed to focus attention on what still needs to be done before the dreams of global electronic commerce can be realised. (Dekleva, 2000, p 3)

Whilst there is little doubt that business to consumer electronic commerce is viable and the market is growing (Larsen, 1999), the underpinning foundations are not yet secure for many reasons. Amongst those reasons, legal issues are prominent. Relevant legal issues could canvass such varied fields as on-line contracts and the validity of electronic contracts, confidentiality, privacy, intellectual property, defamation, censorship, taxation, payment systems and consumer rights. It has been suggested that an attendant lack of resolution and/or lack of clarity represents an ongoing constraint for global ecommerce and that the ultimate success of e-commerce in both the developed and the developing worlds depends, in part, upon the successful resolution by governments and/or virtual organisations of these issues. (Clinton & Gore, 1997, OECD, 1998 and WGEC, 1998).

The current legal structure has perceived weaknesses both from the perspective of the trader and from the perspective of the consumer. As to the consumer, privacy and consumer rights are considered to be prominent issues. As to the trader, the validity and enforceability of electronic contracts and jurisdiction are considered to be prominent issues. It is only possible within the limitations of this paper to consider one of the prominent issues, and that is the issue of jurisdiction.
"Jurisdiction" is a word that has had significant meaning and influence in the offline world for hundreds of years. The problems posed by jurisdiction are not problems created by the Internet and electronic commerce. The global and seamless nature of the Internet has simply added to or compounded the problems as Internet e-commerce (whether it be business-to-business or business-to-consumer) expands and increasingly gains the confidence of the commercial and consumer sectors. Whilst one could mount compelling arguments in support of the view that territory based laws based on arbitrary borders are inappropriate in the world of e-commerce disputes (Johnson & Post, 1996; Jew, 1998), nevertheless such disputes are almost entirely determined according to traditional concepts of territory based laws.

A major Australian study came to the view that "e-commerce may result in the creation of a single world economy even though individual corporations may operate in a national or regional setting" (AUSTRAC Report, 1999).

Whilst international courts (such as the International Court of Justice in the Hague, Netherlands) may play a meaningful role in the resolution of inter-country disputes, such courts have little real power or control (let alone enforcement ability) in the area of e-commerce disputes. Individual countries remain reluctant to relinquish their so-called "national sovereignty".

Anyone involved in international e-commerce or interstate e-commerce must have an appreciation of the applicable legal regimes.

JURISDICTION IN THE E-COMMERCE SECTOR

Jurisdiction can mean many things depending upon the context in which the word is used. Jurisdiction can refer to the limitations on the rights of certain courts to hear certain disputes. As an example, an industrial dispute will not be able to be heard by the Family Court for it is not the appropriate jurisdiction. Similarly, a motor vehicle accident claim involving personal injury must be instituted (in Western Australia) in the District Court because that is the appropriate jurisdiction. When one comes to the world of commerce, jurisdiction takes a slightly different meaning. In basic terms, it refers to the right and ability of a court to hear and determine a dispute. As an example, a business (based in country A) may well place an order on the net (using his or her local ISP) for the purchase of a quantity of goods with an online supplier (based in country B). The supplier will receive the business 'order' (using his or her local ISP) and may well, in turn, place an appropriate order for purchase and direct shipment to the business in country A, with a manufacturer (based in country C) who receives and confirms the order using his or her local ISP. If the goods subsequently do not arrive, arrive late, or arrive (with the business based in country A) damaged or faulty and, assuming that negotiations to resolve or rectify the problems cannot be successfully concluded, where and between whom is the dispute to be taken? In other words, which is the appropriate jurisdiction to hear and resolve the dispute?

To reduce the question to a basic level, if you purchase a CD over the internet from a merchant in Singapore, will the law apply as if you had travelled to Singapore and bought the CD there, or as if the merchant had travelled to Australia and sold the CD to you here?" (Cameron, 2000, p 14)

Before proceeding to consider the approach taken by some of the courts of various countries to this question, three comments need to be made. Firstly, if a plaintiff (the person taking the action) cannot convince the court in which he or she initiated the action that it is the appropriate forum, then the case will not even get off the ground, and the substantive issues involved in the dispute will become irrelevant - what a waste of time, money and resources that could be! Second, even if the court is satisfied that it does have jurisdiction to hear a case, it may decide, for various reasons (such as cost, convenience and the interests of justice), that it is more appropriate to send the matter for hearing to the courts of another country. Thirdly, even if the plaintiff does select and satisfy the court that it is the appropriate jurisdiction, and assuming that the action is successful and an order such as damages in favour of the plaintiff is made by the court, the enforcement of the court's orders by the plaintiff may be problematic especially when one considers a defendant (the person who is being sued) who is based in another jurisdiction. On the other side of the coin, a business that chooses to ignore a 'foreign' judgement issued against it may well be adopting a very dangerous business judgement. These issues will be returned to later in this paper.
THE US APPROACH

Whilst the decisions of US courts may not be binding on Australian courts, they are certainly useful and influential and may provide guidance to the future likely approach to be adopted by Australian courts.

It is true to say that most of the decided cases relating to e-commerce disputes have been decided in the courts of the United States. In many of those disputes the defendants (who in most cases have been the trader or merchant) have raised, as starting arguments, that the court in which the defendant has been 'forced' to defend himself or herself does not have jurisdiction to hear the case and that the courts of another place are more appropriate. The reality is that a defendant would prefer that the case did not exist in the first place but, given that it does, the defendant would prefer the case to be heard in his or her 'preferred' jurisdiction which usually will be the place where his or her business is principally located. A case run in your 'preferred' location will be more convenient, probably cheaper and certainly disadvantageous to the other party who is based outside the jurisdiction and who does not have local knowledge or contacts.

Mention must also be made of the fact that in most areas of law, the various laws of a US State are governed and determined by the legislature and the courts of that US State. Accordingly, the laws and, in turn, the views of the courts with respect to jurisdiction can vary and the courts, unfortunately, have not always spoken with one consistent voice. This is not a problem isolated to the US, it is a worldwide issue of concern to which no apparent near future answer is available.

In the US, as a guiding principle, a court in one State will 'take' or exercise jurisdiction over a willing or unwilling defendant from another jurisdiction if the plaintiff is able to prove that the defendant has had the 'required minimum contact' with the plaintiff's chosen jurisdiction in such a way that the justice and fair play cannot be seen to be offended. What then is 'required minimum contact'? The answer to that seems to be that the defendant has 'purposefully availed' himself or herself of the privileges of doing business in the plaintiff's State in such a way that the defendant should reasonably expect, in the event of dispute, to be brought before (hailed before) the plaintiff's State courts to resolve the dispute. In other words, the defendant has taken the benefits of doing business in the State.

Whilst it is easy to use words such as 'required minimum contact' and 'purposeful availment' it is much more difficult to determine, in any given fact situation, whether the tests have been satisfied. One needs to look at the quality, quantity and nature of the defendant's contact with the State and perhaps the best way to understand the guiding principles of the US position is to consider some e-commerce cases (all of which have been decided in the last few years) that required the courts to consider and resolve the question of jurisdiction. Before looking at these examples, it is worth noting that the nature of the underlying cases (being based in, say, copyright law or trademark law or patent law) is of no concern - what is of concern is the resolution of the issue of jurisdiction. Once a court accepts its right to hear the case, the case proceeds - if it does not so accept, the case needs to be dropped or transferred to the appropriate jurisdiction.

In the first example, the defendant, based in State A, was sued for trademark infringement in State B. The defendant had no offices or employees in State B, nor did it regularly carry on business in State B. The defendant had Internet advertising and a toll free phone number which could be accessed by all Internet users. Residents of State B had accessed the advertising and used the toll free phone number. The court of State B decided that it did have jurisdiction and the case proceeded against the defendant's wishes (Inset Systems).

In the second example, the defendant based in State A was sued for trademark infringement in State B. The defendant's website (hosted in State A) contained a link that, if activated by a user, would automatically send more information to the user. Residents of State B had accessed the website and activated the link. The court of State B decided that it did have jurisdiction and the case proceeded against the wishes of the defendant (Maritz v Cybergold).

In the third example, a defendant, based in State A was prosecuted in State B for offering illegal gambling. The defendant had a website (hosted in State A) which advertised the future intention to operate an offshore online gambling service. The site provided a toll free phone number for further information but did warn users to ensure that they complied with their State's legislative provisions. Residents of State B were in contact with the plaintiff. The court of State B decided it did have jurisdiction and the case proceeded against the defendant's wishes (Minnesota v Granite).

What do the first three examples suggest? It is suggested that to satisfy the 'required minimum contact' and 'purposeful availment' tests not a lot of Internet contact is required. Access to a web site, the provision of Internet accessible advertising, the provision of toll free numbers for further information, the provision of links accessible
for further Internet information, coupled with the reality of access, may all collectively or perhaps independently of each other, lead to or support an inference of the availability of jurisdiction. It is interesting to note that none of the examples enunciated above even involved the active creation or attempted creation of an online contract and presumably, if that had been the case, the finding of jurisdiction could even more easily have been made.

This assumption is supported in another case where a defendant was based in State A and had an Internet Service hosted in State A, but many residents of State B had joined the defendant's site as 'fee for service subscribers'. The defendant had no office nor employees in State B. Jurisdiction in State B was found in a trademark infringement case (Zippo Manufacturing).

A word of caution on the US position needs to be made at this point. Not all the cases have found jurisdiction to the detriment (or perceived detriment from the defendant's point of view) of the defendant. In a fourth example, the defendant was based in State A with a web site presence, hosted in State A, advertising his State A jazz club called "The Blue Note". The plaintiff was based in State B and had the trademark in State B for the same words for his jazz club. The plaintiff sued in State B for trade mark infringement but the court in State B declined jurisdiction because the defendant site made no sales (contracts) in State B, the defendants site stated that it had no association with the plaintiff's trademark, and if a user was to ring the phone number provided by the defendant's website, the tickets would be issued but could only be collected from the box office in State A (Bensusan Restaurant).

One final (fifth) example is especially worthy of mention. In this case the defendant was based in State A but did have some other online business in State B. The defendant's subsidiary 3 (a company called Y) operated an offshore gambling casino website from a server based in country C, which was properly licensed by country C. The gambling website did target US residents many of whom could, of course, be residents of State B.

Because Internet gambling is illegal in some US states (including State B) the site required intending users (before they could effect any gambling transaction) to electronically input their residential address and the site was configured in such a way that if a nominated residence was entered from a potential user from a 'barred' state, that user was prevented from proceeding to effect betting transactions. The defendant was sued for a contravention of State B's antigambling laws. Considering the above facts, a strong argument can be mounted; firstly that any gambling that was done by residents of State B was offered to them by Company C not the defendant; secondly that the gambling was being effected 'offshore' and not in State B; and thirdly, that any bets placed by residents of State B were received innocently and without intent by the defendant (or if you like Company C) because of the installation of the address filtering software on Company C's site. None of these arguments persuaded the court of State B to decline jurisdiction. The court found that the defendant conducted business in State B, the defendant actively sought the business of the residents of State B, that Company Y and the defendant were in reality one and the same, that there were State B gambling users of the site, the gambling by State B residents took place in State B and, perhaps most importantly, that the mere use of address filtering software (without further checking and verification) could too easily be avoided and accordingly did not provide a compelling argument as to the question of jurisdiction (People v World Interactive).

THE AUSTRALIAN APPROACH

The approach of the Australian courts to the issue of jurisdiction is slightly different to that adopted in the US. Notwithstanding the differences it is suggested that the end result (ie the finding of jurisdiction or otherwise) will usually be the same. Unfortunately in the area of e-commerce, there is a dearth of cases in Australia that have needed to canvass or resolve jurisdictional matters. Nevertheless, the non-e-commerce Australian position in this area is worthy of mention. As a starting point to establish jurisdiction, the defendant must either agree to accept the jurisdiction of the nominated Australian court (and if he or she does so, then no further jurisdictional problems will usually arise) or, in the absence of acceptance, the plaintiff must be able to establish that service4 of the court proceeding has been made upon the defendant. Under Australian court rules, service out of the jurisdiction is possible but often requires the leave (permission) of the court in question. If a defendant is not 'served' with the papers, it would generally be an affront to justice to proceed in his or her absence because he or she would, unaware of the court hearing, obviously be unable to enter a proper appearance and defence. Given that service is properly affected, then still an Australian court will only hear a case, that is within its limits, if

3 A subsidiary is a company that is controlled by another company (usually called its holding or parent company) but the subsidiary (in traditional Corporations law) is a separate company with a separate existence in its own right
4 Service means proper and adequate delivery (usually in person)
there are sufficient connecting factors between the court and the subject matter of the dispute and/or the parties to the dispute.

It is not that long ago that people could be heard to say that when you are deciding jurisdiction on the web, that jurisdiction is to be determined by the location of the server. As an example, if music is downloaded in Switzerland using a Swiss server, then the law to enforce infringement would be Swiss law. It was not long before the courts (all around the world) realised that such a restrictive view was inadequate and led to arbitrary results not necessarily leading to justice and, indeed, in many cases leading to the opposite result - the avoidance of justice. Whilst the location of the server remains one factor to consider, it must be considered as part of the whole picture. Other matters to be considered (none of which in isolation may be sufficient to create a finding of jurisdiction) include the places of residence of the disputing parties, the places of businesses of the disputing parties, the place of the offending conduct, the place of the transaction, the location of the computers that access the offending material, where the goods and services emanate from and are delivered to, in what way was the payment effected and in which currency was payment made, and so on.

STRATEGIES FOR REDUCING OR MINIMISING THE RISK

At the outset it must be made clear that even the most careful and prudent business person taking all or any of the steps that are suggested below may unwillingly find himself or herself brought before a court in another state or a foreign country to answer a claim relating to an e-commerce/Internet/web based transaction, contract or conduct of some form. Nothing in this area is foolproof but some of the following strategies may assist and require little energy or effort to implement.

The first obvious suggestion is that if you are involved in the offering via a website of online contracts (or indeed if you are negotiating any contract including a website development agreement) you should prominently include within the contract a jurisdiction clause. Don't forget that you, as the merchant, are in the driving seat here as you will be in a position to nominate (if done properly) the terms and conditions as to which the consumer has very little opportunity to amend or object. The clause (as long as it is seen as part of a valid and enforceable contract) need not be complicated but it should be clear, obvious and well written. The clause should state that in the event of any dispute of whatsoever nature, the dispute will be governed and determined in accordance with the laws of say, Country X. Care must be taken to ensure that the other party has adequate notice of the terms and conditions (in this case, the jurisdiction clause) prior to the entry into of any arrangement or contract.

Further, the clause should also state that the appropriate courts of Country X will hear the dispute. This extra step is a worthy addition because it is possible, albeit in rare circumstances, for the courts of say Country Y to determine a dispute according to the laws as they apply in Country X. This is not the outcome you were trying to achieve! In countries which have their laws partly or totally broken up into regional or states based law, it would be wise to nominate that the laws of that state (rather than the country as a whole) should determine the dispute. This would hopefully avoid the problem of say a Western Australian company being brought to account before say, a New South Wales court.

An example of a clause (without giving you legal advice, which you must obtain as the need arises) might contain words akin to the following:

This Agreement shall be governed by and construed in accordance with the laws of [insert your country or state]. All aspects of all actions brought relating to the subject matter of this Agreement shall be governed by [your country or state] laws. The parties hereto hereby consent to the exclusive jurisdiction and venue of the Courts of [your country or state] for any action that may be brought in connection with this agreement.

As previously mentioned, the insertion of such a provision into the contract or arrangement does not necessarily guarantee the success or enforceability of the provision. As an example, under the Australian Trade Practices Act, 1974, certain consumer protection provisions may not be excluded by providing for a foreign law as the governing law of a contract.

Another strategy that you could employ is to expressly exclude from your sites, sales to, or contact with, the residents or businesses based in certain countries. Customers must, of course, be required to identify their country of origin. You may choose to adopt this approach because you may either feel uncomfortable or unfamiliar with the laws enunciated in those countries or because the courts of those countries have adopted (in your view) an over-enthusiastic willingness to accept jurisdiction in disputes. It perhaps goes without saying that the negative side to adopting such an approach is the potential loss of trade or business opportunity. That is a judgement you will need to make.
Another strategy (closely aligned to the last one) is to limit within your site or otherwise, the target markets to the residents or businesses of certain nominated countries. In this way you can better have an understanding of the applicable laws in those nominated countries and feel more comfortable with issues pertaining to disputes and jurisdiction.

A final suggestion (where that is possible) is to limit the interaction offered by the site. Cases already discussed within this paper suggest that a 'passive site' will be less likely to lead to a finding of jurisdiction. As previously indicated, no strategy is foolproof so perhaps the best approach is not to get into dispute in the first place - perhaps easier said than done!

CONCLUSION

The potential problems associated with jurisdiction online and offline are not going to go away. It is unlikely, in the foreseeable future, that the Courts of various countries, or indeed the courts of the States within countries, will speak with one voice. Any business and, in particular, any virtual organisation, should consider the risks inherent in the issue of jurisdiction. If you are conducting business across country borders or across state borders, you might take the view that you can ignore the proceedings taken by a plaintiff in a 'foreign' court because you are far away and the plaintiff cannot touch you at home. Such a simplistic view can be an extremely unwise view. If you want to continue to do business with the plaintiff or indeed with any other person within the plaintiff's country or state, an outstanding court order can pose grave risks to your business and your assets. Blocking of access to your site, injunctions, seizure orders, damages, credit downgradings and penalty orders are all possible depending upon the prevailing circumstances. It is even possible for some of the orders of a foreign court to be registered and enforced in a second country following acceptance of the orders by the second country's courts.

Consideration should perhaps be given to the recent (Nov, 2000) court order imposed on Yahoo!.com by a French court. Yahoo will want to do all it can to comply with the court order because it obviously wants to continue to do business with the French business and consumer markets who have voraciously embraced the world of e-commerce. Accruing pecuniary penalty orders are not good for the bottom line or business image. In this case, Yahoo was ordered by a French court to block access by French citizens to its US hosted auction sites because the sites contained close to 2000 Nazi related memorabilia objects and under French law it is illegal to display or sell such race based materials.

Whilst the French court gave Yahoo three months to find a way to block French citizens from accessing Yahoo's auctions, the effect of the order is that French law has effectively been imposed on an international corporation running its business (from a US server) in the US. Any ongoing breaches of the order could result in fines of up to $25,000/day for non-compliance. Is this the end of the free net as we know it? Will Yahoo be forced to devise or install software that will prevent browsers from accessing their sites every time one of their sites happens to contain an item that could lawfully be sold in the US (and in many other countries), but not in France? (Glater, 2001).

In conclusion, an awareness of the laws of the countries with whose citizens or business you deal is helpful. If you are trading across many jurisdictions that may be nigh on impossible. Adopting some of the strategies suggested in this paper may assist. If you are ever faced with proceedings in a court that is 'foreign' to you, do not ignore the proceedings because (in the absence of a proper appearance, defence and argument) you are likely to be at the receiving end of a court judgement issued against you.

It can fairly be concluded that while it is unlikely that an Australian e-business setting up a website hosted in Australia will be open to jurisdiction in every place where the website is available, if the website actively solicits business in the other forum inviting the purchase of products or services then this would probably be sufficient to place an e-business under the jurisdiction of the other state of country... (Cameron, 2000, p 20).
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END NOTES

1 A subsidiary is a company that is controlled by another company (usually called its holding or parent company) but the subsidiary (in traditional Corporations law) is a separate company with a separate existence in its own right.

1 The approach adopted in Australia is largely the same as that applies in countries whose laws are historically based on the British system.

1 Service means proper and adequate delivery (usually in person).

1 This clause is given for information only. All warranties or representations, express or implied, and of whatsoever nature, with respect to this clause are disclaimed.
E-Government And Government Policy Towards The Internet

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ABSTRACT

This paper draws on the author's experience as the UK Government's first "e-envoy" to bring out lessons in three areas. First, on the scale of change required within government to deliver online services. Second, on the efforts needed to set up successful online forums or consultations. And third, on the need to avoid the overall policy framework being overshadowed by action to counter threats posed by the internet.

Keywords: e-government; internet policy

INTRODUCTION

The author was appointed as the British Government’s first ‘e-envoy’ in September 1999, following recommendations in ‘e-commerce@its.best.uk’ (Performance and Innovation Unit 1999). This paper does not attempt to cover every aspect of Government policy towards the internet, which covers a huge agenda—set out, for example in the Annual Report by the E-Minister and E-Envoy (Office of the E-Envoy 2000). Instead, it concentrates on three areas.

First, on e-government, where much has been written about the radical shift in approach to service delivery that will be required, but less about how such a shift can in practice be brought about. Experience so far serves to highlight the scale of change necessary to achieve the full potential of e-government.

Second, on e-democracy, where the internet offers unparalleled opportunities for communication and consultation. But getting useful results requires considerable effort to set up suitable processes and systems and to avoid new channels being swamped with 'noise'.

Third, on the dark side of the internet such as trading in child pornography, exchange of terrorist information, unregulated gambling and financial scams. Governments need to work together to counter these threats—but at the same time need to avoid booby-traps and stop action in these areas hijacking their wider agendas.
E-GOVERNMENT

The vision for e-government is clear and compelling.

It can provide services in a form that customers want. People are increasingly using the internet for private sector services and expect government to offer the same facilities.

It can enable services to be provided more efficiently and cost-effectively, so that the government can secure savings—which can be used either to enhance other services or other channels of delivery, or to reduce taxes.

And it can enable services to be provided in a more joined-up way, so that people can access government services in a way that makes sense to them, rather than one dictated by the structure of government departments and agencies.

Many Governments around the world have now set targets with the objective of getting all or most government services online. The UK has a target of getting all services online by 2005; Australia, of getting 'all appropriate Federal Government services online' by 2001; Canada, of getting 'all key Government services fully online' by 2004. There are similar targets, with slightly different formulations and dates, for other countries ranging from the US to Hong Kong (Office of the E-Envoy 2001a).

Achieving these targets will raise a variety of technical and technological issues. Many government services are large and complex operations, and moving to online delivery will require substantial investment to update existing IT systems. Managing such projects will in itself raise challenges for Government (Cabinet Office 2000).

The particular issue raised in this paper does not, however, relate to the technology—where the problems are reasonably well understood, even if still hard to handle. What this section instead focuses on is the problems of organising and managing cross-government initiatives.

This relates in particular to the third component of the e-government vision set out above: to enable citizens to access government services in a way that best meets their needs, rather than in a way dictated by organisational structures within government. This represents a major challenge for government. Services have traditionally been delivered via departmental 'silos', and moving towards more joined-up Government presents considerable problems of organisation and accountability. Although many authors have recognised this as an issue, the extent of the change needed has not often been brought out.

An example from the UK illustrates the scale of the challenge. The government has recently developed and set up a portal 'UKonline' (http://www.ukonline.gov.uk). This aims to be a single point of access for those wishing to use Government services online. The framework includes a series of 'life episodes'—initially 'having a baby', 'going abroad', 'dealing with crime' and 'moving home', with five more being added subsequently. All these involve more than one department or agency.

In developing the four initial life episodes, a team of consultants brought various stakeholders together from departments, agencies and in some cases from outside government. They held a series of brainstorming sessions designed to flesh out what might be included in each life episode. The result was a useful aggregation of information relevant to each life episode, organised and indexed in a way designed to make it easier for people to find what they wanted on a particular topic without having to wade through several different departmental web sites. It consisted mainly of information and links to other sites, both in government departments and outside government. There were relatively few transactions enabled initially, though these will be added as they become available.
It might be thought that this should have been a relatively simple task. The reality was that organising how this should be done was much more complicated than had been foreseen. The biggest issue was a management one. Who should take overall responsibility for setting up and maintaining each life episode? Much of the initial work was done from the centre, partly by the e-envoy’s office and partly by the company who had won the contract to develop the portal. But it was expected that a lead department would take over the role once the initial concepts had been developed—the Department of Health for ‘having a baby’, the Home Office for ‘dealing with crime’ and so on.

The reaction of Departments varied. In most cases, they were willing on an ad hoc basis to undertake the work necessary to get a life episode set up, but were reluctant to commit themselves to take full ownership, and responsibility for making sure the information provided was correct and up-to-date. Some argued that they had not been tasked or resourced to take on this co-ordination role, or to ensure that information that was not ‘theirs’ was updated when necessary. It took considerable high-level management effort to get lines of responsibility agreed.

This in itself may seem a relatively trivial bureaucratic squabble. But it serves to highlight some of the difficulties inherent in implementing e-government. The ultimate vision of seamless access to a personalised mix of service from different departments is going to require considerable management and organisational effort, quite apart from any technical difficulties.

This is all the more true when different tiers of government are involved. In the UK, another issue that caused considerable problems was organising content applicable to people who lived in Scotland, Wales or Northern Ireland. This involved negotiations with the devolved administrations in those countries, who were keen to be involved but understandably protective of their particular interests. In a similar vein, bringing local authority services within the scope of the portal introduces yet another set of issues: different authorities are at very different stages in introducing online services, and have a range of different IT suppliers and contracts.

These are not issues unique to the UK. The challenge is widely recognised by governments in other countries too. The international comparisons in “Benchmarking Electronic Service Delivery” (Office of the E-Envoy 2001a) drew out the following comments, most in somewhat coded language:

**Australia:** ‘It is difficult to change service delivery models across the whole of government. ... There is a crucial balance to be struck between collaboration and leadership. Building a collaborative approach to customer service delivery is a fundamental reform that will take some time to achieve, but is essential in the online environment.’

**Finland:** ‘The development of cross-governmental services and their integration with back-office services is a difficult task. The Finnish Government is only just beginning this process.’

**Hong-Kong:** ‘e-government is the transformation of government, not merely the implementation of technology. Changing the mindset of the civil service from a traditional department-centric thinking into a customer-centric and user-friendly approach requires the effort of every individual civil servant.’

**Netherlands:** ‘Co-operation between government departments is a pre-requisite for e-Government.’

What is crucial is that Governments take appropriate action to overcome the hurdles. In the UK, for example, all departments are now required to produce e-business strategies, which must include ‘an outline of how services will be joined up through effective links with other organisations delivering related services to similar customers’ (Office of the E-Envoy 2001b). This is being backed up with a toolkit to provide practical support to departments in re-engineering the delivery of Government services around the user (Office of the E-Envoy 2001c).
In addition, the Government Gateway (http://www.gateway.gov.uk) is providing a single authentication service for Government departments, which will enable joined-up transactions between different departmental legacy systems.

**E-DEMOCRACY**

E-democracy covers a wide range of topics, but the particular aspect addressed in this paper is the use of the internet to provide enhanced communication between citizens and elected representatives and between citizens themselves.

The internet has not yet lived up to its promise in this area. It has worked well in increasing the information provided from governments and elected representatives to citizens. But it has worked much less well in enabling citizens to express their views to governments or elected representatives. Although many government departments, agencies and individual elected members have published email addresses and set up online forums, these have mostly had only a marginal impact on the policy debate or on policy decisions.

In part, this is because of a lack of appreciation of what is required to organise online discussions or consultations successfully. Simply setting up a forum and opening it to all-comers is most unlikely to be successful. Such forums tend to become fragmented and to be dominated by a few individuals who feel strongly about particular issues. At the same time, it is often unclear whether departments or agencies have a policy of monitoring and responding to comments in the forum, and this can rapidly lead to disillusionment among participants. Moderation of forums can itself raise problems: if it is seen as stifling discussion, that in itself can become the focus of debate.

Running successful online consultations is time-consuming and resource intensive. But if done properly it can be rewarding. In the UK, the Hansard Society has undertaken online consultations on domestic violence (Coleman and Normann 2000) and on barriers to welfare to work (Hall 2001). Considerable effort was made in both cases to secure participation from those directly affected, and that contributed significantly to the results achieved. It helped create networks that could not have been built up through other means—though the scale of effort needed means this approach is not a panacea for using the internet to generate responses to consultations.

Handling email presents similar problems. Many elected representatives are fearful or unclear about how to handle the volume of traffic that can be generated. The US House of Representatives received 7 million emails in December 2000, and individual Senator’s offices can receive 55,000 emails a month (Congressional Online Project 2001). A major contribution to this has come from advocacy groups and grassroot activists who have encouraged mass-emailing of Members of Congress. It must be doubtful how far such groups will voluntarily exercise self-restraint, and systems involving filtering and automated responses are likely to be necessary. But as the Congressional Online Project study reports, relatively few Congressional offices use the available software that can handle such volumes effectively.

The volume of email traffic to UK Members of Parliament is far lower, but similar issues arise. The Hansard Society is helping develop suitable filtering software and is also investigating systems whereby constituents could be identified by digital signatures, so that their email can be quickly picked out and dealt with.

These initiatives are vital if the full benefits of the internet to the democratic process are to be realised. At present citizens can be much better informed through online access to information, but lack effective new channels to put across their views and reactions. That is an unbalanced position, and more research is needed into developing ways in which governments and politicians can get informative feedback.
COUNTERING ILLEGAL OR UNDESIRABLE ACTIVITY THE INTERNET

The internet has its dark side—one that gets ample publicity. The ease of communication and the opportunity for anonymity provide many benefits, but they also offer opportunities for a range of illegal or undesirable activities. Well-publicised examples include distribution of child pornography, unregulated gambling sites, communication of terrorist information, and financial scams such as share-ramping.

Governments are grappling with how best to deal with these issues, both through domestic legislation and through international co-operation. But in doing this, they need to maintain a coherent strategy, and particularly a coherent presentation. Otherwise, there is a risk that action in these areas will overshadow more general campaigns to promote internet use, or will be seen as inconsistent with those campaigns.

Some examples serve to illustrate the problems that can arise: the UK Government’s legislation on email interception; and the Australian Government’s legislation on online content and on interactive gambling.

INTERCEPTION OF COMMUNICATIONS

The usefulness of email as a means of communication is just as relevant to criminal activities as it is to legitimate business. That has led to Governments seeking powers and means to intercept emails on a similar basis to phone conversations, faxes or letters. At the same time, the increasing availability of encryption services has led to a perceived need for new powers to enable the relevant authorities to decrypt seized or intercepted material.

Interception of communications has long been a sensitive issue, raising concerns about threats to civil liberties. It has been hard for Governments to pick their way through the various competing interests, especially when the underlying technologies can change rapidly. The opposition to the US Government’s “Clipper Chip” proposal, first unveiled in 1993, provided an early example.

In February 2000, the UK introduced its Regulation Of Investigatory Powers Bill. This contained provisions which required ISPs to set up facilities to enable emails to be intercepted once a warrant had been issued, and required the surrender of decryption keys in certain circumstances (Home Office 2000). Earlier proposals involving the use of key escrow systems had been dropped.

Because of the difficulties of dealing with future technological changes, the provisions in the Bill were cast in fairly general terms, with much of the detail to be included in subsequent statutory codes of conduct. This lack of detail in itself caused concerns, with objectors pointing to a variety of draconian actions that they argued would in theory be permitted under the Bill—going to jail because someone had innocently forgotten a decryption key was one example. There were suggestions that some inward investors would be put off coming to the UK because of the provisions—though no evidence of this happening in practice.

What started as a fairly low-key objections rapidly grew in intensity. The Government had to put in much effort to allay the concerns, and some provisions in the Bill were amended. The debate on this often overshadowed action that was being taken on other parts of the Government’s e-commerce and e-government’s agenda. It revealed the need for more to be done in advance to identify the likely points of difficulty and to present the counter-arguments more clearly if such measures are not to damage the Government’s stance on its wider internet agenda.
ONLINE CONTENT AND INTERACTIVE GAMBLING

The way the Internet spans national borders presents particular problems in dealing with illegal or objectionable content. What may be illegal in one country may be legal in another; and countries where material is legal have little interest in helping to prevent access via the internet from countries with more restrictive regimes.

Some material—such as child pornography—is illegal in almost all countries. In such cases, Governments and law-enforcement agencies have co-operated to track down offenders, and have had some successes in prosecuting those involved.

For other types of online content, Governments have reacted in different ways. The UK, for example, has not sought to bring in new legislation to update its obscenity laws. It has relied on industry self-regulation via the Internet Watch Foundation to deal with complaints about objectionable content, with existing legislation as a potential back-stop.

Australia, by contrast, passed the Broadcasting Services Amendment (Online Services) Act 1999 with the specific objective of extending the existing classification system for film and television to the internet. This makes certain content “prohibited” in Australia, whether it is hosted in Australia or overseas. During the passage of the Bill, considerable concern was expressed both about the potential impact on Internet Service Providers in Australia in fully meeting the requirements of the Act, and about the likely ineffectiveness of the legislation in stopping all “prohibited” material being accessed from Australia. This debate attracted public attention not just in Australia but overseas, portraying the Australian Government as attempting to ‘censor the internet’. In practice, the legislation has been implemented largely based on industry codes of conduct, overseen by the Australian Broadcasting Authority.

Online gambling is another issue causing problems for Governments around the world. Once again, different Governments have taken very different attitudes. The US Government has taken the view that “there is a strong law enforcement priority to prohibit Internet gambling” (Department of Justice 2000)—though States such as Nevada take a different view. By contrast, a recent Government-commissioned report in the UK said “We are clear that it would not be right to try to ban on-line gambling in the UK, and it would not, in any case, be feasible to do that.” (Gambling Review 2001).

In Australia, the focus has been on problem gambling, particularly following the Productivity Commission’s report. That led the Government to introduce legislation (the Interactive Gambling Act 2001) to stop Australian operators offering online gambling services to Australian citizens. It does not directly restrict Australian citizens accessing offshore sites, but prevents such sites advertising in Australia.

As with the legislation on content regulation, this legislation attracted considerable publicity within Australia. There was opposition, for example, to the inclusion of sports betting within its scope—based both on industry arguments and on the illogicality of allowing bets to place over the phone but not over the internet—and the legislation was subsequently amended to exclude most wagering on sporting events. There were also questions whether the legislation would be effective in its objective of reducing problem gambling, and whether it was potentially cutting Australia off from new business opportunities.

There may have been sound political reasons for the Australian Government to take a tough stance on online content regulation and online gambling. But as with the UK example, the debate tended to overshadow what the Government was doing in other areas to promote the use of the internet, and led to criticism that the Government was losing focus on its e-commerce agenda.
One of the problems for governments is that their action in these areas is often seen as more newsworthy than—for example—promoting internet use in schools. This is compounded by the weight of media coverage given to other activities on the dark side of the internet—to hacking and credit card fraud in particular. The cumulative effect of this concentration on potential problems with the internet can serve to put people off from getting online or making purchases online.

Governments need to take account of this, both in planning their own communications strategy, and also in deciding on policy priorities. It is unrealistic to expect that the e-commerce and e-government agendas should always take priority over policy proposals in other fields. But it is important that the potential pitfalls are brought out, and that a coherent strategy is developed for handling the problems that may arise.
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Wireless emails: Issues, Challenges and Guidelines for Implementation

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ABSTRACT

Email represents just one of the many channels through which one person can convey information to another, within or among organizations. The advent of wireless technology has enabled emails to be accessed via a network or remote access has transformed email into a mobile tool. These wireless emails, equipped with devices such as wireless phones and personal digital assistants (PDA) are competing for wireless data access. However, the unexpected growth in recent months in using these wireless emails has opened up a gamut of management problems. This paper discusses two specific issues relating to wireless emails that effect both organizations and end users, namely, data integration at organization level and ad hoc collaboration among mobile workers along with the technical guidelines needed for an organization to changeover to wireless emails.

Keywords: e-Commerce, wireless emails

INTRODUCTION

Today’s wireless emails are still in their infant stages (Smith & Andrews, 2001). These emails enable users to access organization emails in a non-connected mode. When such connections are established, security, access and privacy of data become important issues. A number of solutions have emerged in recent months to provide mobile email services in a secured manner for organizations. These solutions use some form of wireless technology such as Bluetooth protocol, a wireless application protocol used by Ericsson. Gartner Research predicts that by 2004, about 65% of Fortune 2000 companies will be offering wireless emails and personal information managers to their mobile employees. IS organization managers will need to deal with an ever-increasing amount of traffic to meet this demand to support numerous operating systems, devices and users that are not physically located in the office, and to address security issues and other management issues associated with this traffic (Schiller, 2000). These issues will become prominent very soon because the mobile user’s first requirement is predicted to be access to emails, calendaring and contacts. If organizations ignore these mobile user’s data needs, they will force these users to move to unsecured and unauthorised methods of remotely accessing emails, such as redirecting to a public website or through PC based software. This could, in turn, place the entire organization at risk, as corporate email will sit vulnerably on a public server, which can be accessed by unauthorised users. Therefore, while the IS managers have a responsibility to provide high quality service to their users, they also have the responsibility to protect corporate networks and data from any unauthorised use. The implementation of these responsibilities in a wireless context throws open issues and challenges that have not yet been encountered so far by IS managers. This paper highlights two specific issues in the wireless email usage, namely data integration at organization level and ad hoc collaboration among mobile workers. The discussion is followed by implementation guidelines for IS managers who are not familiar with wireless email technologies.
DATA INTEGRATION

Data integration refers to the collection of data in an organization either at one point or at several points (Arena, 2000). Usually raw data is captured using forms, telephone interviews or by other mechanisms and then transformed into a form suitable to an organization’s needs. Traditional emails are used as a tool to collect data such as a user’s profile. Although information is submitted in an email message, all too often it is re-transcribed for one of the back-end systems. When such transcription takes place, valuable information is often lost due to typographic errors and lack of other verification systems. In many cases, organizations do not capture data when the business transaction is not fully realised. For example, a customer company inquires about a product and asks to buy 10,000 units of a product by a certain date. The selling company is unable to meet the requirements of the customer and does not win the bid. The selling company usually does not capture the customer details from the email, such as which products the customer was interested in. If this information was captured in the customer database, then this would allow it to be leveraged into future business. This leads to incomplete data integration in an organization because when this product line is re-evaluated there is no means of cross-referencing the information with customer needs. Further, the lack of data integration introduces a barrier when analysing the reasons for the loss of the bid – whether caused by timing, product quality or product availability? Therefore, data integration is an essential ingredient for an organization’s success.

One of the reasons cited for such problems is the high cost involved in transcribing data and verifying the accuracy of the data once it is transcribed (Shroeder, 1999). Further, there is a time lag between the original data and transcribed data and businesses may not be able to afford such time delay. While wireless emails provide a "good enough" technology layer that has some significant advantages such as accessibility, reliability of addressing and minimum effort in setting up, real economies can be realized when the information is collected on location, as a series of fields of information, and transmitted electronically to the home office, where it was directly inserted into a database. This process is one-step better than that of capturing information using traditional emails and then transcribing them into appropriate databases (Young, 2000). When using wireless emails, re-transcription of the information can be eliminated and the time taken to process data can also be significantly shortened. However, from an organization’s point of view, emails need to be identified properly in order to integrate data to relevant databases. Further, for monitoring purposes, the originator and other signatory elements involved in the email need to be identified for security and authentication purposes. In addition, data transmission security issues become a major concern to organizations. This concern can be addressed by using Email response management systems (ERMS) to sort messages, allocate them to automated processing or human review as required, and track the turnaround time to ensure quality answers and timely response to the customer. However there are other challenges to be met and these are discussed later.

AD HOC COLLABORATION

Mobile email is an ad hoc communications tool. These ad hoc networks are formed for specific purposes and once the purpose is no longer required, they are easily abolished and the communication channel discontinued. Using the wireless technology, it is possible to form ad hoc networks quickly. Wireless application protocols claim that these ad hoc networks can be formed in a secure and reliable manner. With voice and data a definite reality in the wireless domain, such ad hoc communication will soon be realised using wireless email (Smith & Andrews, 2001). While tools to facilitate these ad hoc communication channels are not commonly available to date, a number of vendors are building on the ubiquity of e-mail to create ad hoc collaboration tools that use generic e-mail — independent of vendor platform. Examples of vendors include Abridge, Intraspect and Quickplace. These tools allow the easy creation of working groups composed of people who may not all work for the same division or organization, or who may not even be in the same country. E-mail is the common denominator that links them all. Such grouping is of extreme importance in service sectors.
However, not all email applications improve ad hoc data integration. For example, IMAP, a fetching protocol allows the user to keep and organize files on the server. It enables only a shared folder. While the shared folder is one of the ways in which communication can be established, such communication is very restricted. IMAP by itself does not provide any other collaboration tools. In wireless email, if such collaboration is not fully endorsed, then these communication channels do not provide the full capabilities of communication (Lovell, 2000). There are, however, other ways to leverage simple generic wireless emails to perform a rich level of collaboration, but this is beyond the scope of this discussion.

A number of users have questioned the reliability of SMTP, message-oriented middleware. The strength of SMTP messaging is its ubiquity because its ease of implementation and use are contributing factors to its ubiquity. Building more capabilities directly into the protocol (with requirements for more-sophisticated implementation everywhere) is probably not advisable; building more reliability into a particular service is more desirable. In the 'last mile', an organization is at the mercy of the destination system which it cannot always control as it doesn't own the destination system's budget. Depending on how much of the path an organization can control (and how much it is willing to pay for it), it can either improve the service, or layer on top of e-mail some tracking numbers, receipts, encryption or check sums to provide assurance of delivery, non-tampering and authentication of the recipient. Without the 'last mile' it may be difficult to establish reliable collaboration.

THE CHALLENGES

A number of users have questioned the reliability of SMTP, message-oriented middleware. The strength of SMTP messaging is its ubiquity because its ease of implementation and use are contributing factors to its ubiquity. Building more capabilities directly into the protocol (with requirements for more-sophisticated implementation everywhere) is probably not advisable; building more reliability into a particular service is more desirable. In the ‘last mile’, an organization is at the mercy of the destination system which it cannot always control as it doesn’t own the destination system’s budget. Depending on how much of the path an organization can control (and how much it is willing to pay for it), it can either improve the service, or layer on top of e-mail some tracking numbers, receipts, encryption or check sums to provide assurance of delivery, non-tampering and authentication of the recipient. Without the ‘last mile’ it may be difficult to establish reliable collaboration.

THE CHALLENGES

Both data integration and ad hoc collaboration brings in new challenges to both organizations and end users (Evans, 2000). In addition, service providers who provide a number of services to facilitate access and communication also face new challenges when it comes to wireless emails. Three specific challenges are as follows:

For the organization, wireless e-mail moves further away from corporate control — threatening to undo the effort and expense of the past five years in standardizing e-mail, ensuring reliability and reducing cost of ownership. For service providers, the fragmentation of messaging technology, delivering multiple e-mail, voice mail and instant messaging services, becomes even more apparent. These service providers would like to know how does a user process a single stream of communication when working with multiple services and multiple devices? For individuals, many of whom already find the volume of e-mail a major problem in work scheduling, a new source of peremptory interruption will arrive.

THE ORGANIZATION CHALLENGE

Providing e-mail to wireless devices is more complex and demanding than providing it to desktops. Organizations must move toward a service provider model as the demands of e-mail services become more diverse. The challenges that threaten to drain the organization of time and resources are:

The increased complexity of multipart communication chains.
The diversity of ever-changing devices.
The need to accommodate not only e-mail access, but also access to other applications.
These challenges will cause many organizations to consider using external services providers (Arena, 2000). Even where organizations continue to operate internal services, the approach will shift from a standardized package of pre-configured services delivered to each employee, to a "cafeteria service" where options and service levels are defined. This will enable employees to select options and service best suited to their particular needs. This will also enable organizations to provide varying services to departments based on their needs. This has an influence on the organization's cost and impacts practical and cultural shift.

The Service Provider Challenge

Users are looking for communication services but very often what they are offered is a jumble of service plans for different capabilities, on different devices, with inconsistent coverage. At the most basic level, few communications providers can even offer unified billing or customer service arrangements for wireless and fixed-line voice services. Moreover, inside the organizations there is rarely any coordination between those responsible for providing voice services and data services. Unified messaging remains for the most part a discussion only and not implemented fully. Each locus of control might attempt to offer "unification" of various message media, but they often miss the mark. For the user, it is important to unify messages between services, even for a single medium, rather than all message types coming into one destination because unification will facilitate to organize messages based on specified criteria.

The fundamental problem is that messaging technology enables organizations to deliver messages to addresses, not to people (Green, 2000). Once mobility is introduced, the inadequacy of this approach becomes apparent because users with different addresses will not be able to link services. This will force users to access different services using different devices. Responses are slowly emerging, reflected in vendor realignments such as the merger of Phone.com and Software.com to create OpenWave, and in a few innovative services such as Linx, I-Link, AccessLine and Call Sciences. However, due to the infant stages of the wireless and associated technologies, it may take some time before vendors providing provisions for integrating various services in order for users to access them using one access. For instance, in Australia, Telstra, the national telephone carrier, offers one billing service for mobile phones, the Internet access, mobile phones and other fax services.

The End User Challenge

Once users gain some control over fragmented channels, another problem becomes apparent: there is no management of messages delivered to multiple devices. Most messaging software assumes that there is one message origination point and one end point, and that a user is equivalent to a single device (Evans, 2000). When using multiple devices, there may be multiple copies of each message, some perhaps transcoded to accommodate different device capabilities. If one message is deleted, what happens to others? Is a reply from one place visible from other devices? These are difficult issues that software vendors are just beginning to address and that service providers have not even considered. If these difficulties were not resolved quickly, this would result in wireless e-mail adding substantially to the burden of message management; in a significant number of cases and hence the rejection of the wireless opportunity.

Wireless e-mail is about to hit the "Peak of Inflated Expectations" on the Gartner Hype Cycle. However, it is likely that once it falls into the "Trough of Disillusionment" within the next year, it may take two or three years before it hits the "Slope of Enlightenment" and finally reaches the "Plateau of Productivity." However, there is value to be had now from wireless e-mail. Organizations and service providers need to give more consideration to end-user needs.
WHAT TO DO: MOBILE MESSAGING BEST PRACTICES

Best practices guidelines for e-mail or any implementation include (Shroeder, 1999):

Recognizing a problem
Recognizing that there is a need is the first step. A lot of technology is invented before a need actually exists, but technology works best when it provides a service or makes a product faster, cheaper or easier to use. The same concept works here. Are users requesting access to e-mail when they are out of the office during work hours? Which users fit this description best? As e-mail increasingly becomes a main communications method in the workplace, more users will demand "anytime, anywhere" access. Wireless is the only technology that fits this description.

Assessing needs and solutions
Assessment is twofold. First, organizations must understand what type of devices are preferred, what is the travel and coverage needed, and how much usage is expected. Wireless e-mail incorporates three main components: the terminal (phone, notebook, pager or PDA), the network (cellular/PCS, CDPD or dedicated data) and the application itself. By performing a self-assessment, an organization will have a better understanding of its general needs and potential service rollout costs. Evaluating what applications, networks and terminal suppliers fit those needs is also important. One device or network does not suit all, so choosing a solutions provider (one that packages hardware, software and services for easy implementation) or putting the pieces together in-house will be easier when the organization's initial assessment of needs is completed.

Implementing a solution
Implementing the service should be the easiest part. Most applications for wireless e-mail reside on a server and directly integrate with both Outlook and Lotus Notes (most e-mail applications target Notes or Exchange). Most solutions are shrink-wrapped and designed to work out of the box with little customization. Implementation also includes providing terminals and training for users, as well as adopting network services. Testing the wireless service for coverage is essential, as some of today's wireless e-mail solutions do not reach all users because of wavelength problems. So if signals don't adequately reach where the majority of users live, work and play, the service can't be effectively used. Multiple networks may be needed and are common, especially when the organization is supporting multiple devices across a large number of geographically dispersed users.

Administrating the application
Administration should deal mainly with the day-to-day issues, such as security for those forgetting mobile passwords, working with network service providers, and supporting mobile devices and their peculiar behaviour. Requests for IT support can increase by as much as 25 percent during large-scale projects, especially at the beginning.

Evaluating the results
Evaluation is the last step — but an ongoing one — in supporting wireless e-mail. Organizations should ask themselves the following questions:
Which devices do users prefer?
What's new on the market?
What are the main issues/problems that users have?
What are the usage amounts, and are they increasing, decreasing or staying level?
What coverage is needed, and is that changing?
Are there any revenue increases or cost decreases that can be associated with this application?
BEST PRACTICES – WIRELESS EMAILS

Organizations should consider the following before implementing wireless e-mail (Lovell, 2000; Stowe, 2000). Gartner Research Group also provides guidelines along the following lines:

Leave device preference to the user as some may choose phones, others PDAs, depending on their style of work. In the end, an organization may need to support more than one device, depending on preference and network service available. This should last only until 2004, when devices become less tied to local applications for sending and receiving data.

Adopt a solution that isn’t restricted to a proprietary device, network or server. Don’t try to manage multiple e-mail systems internally, but develop a centralized one that supports both wired and wireless architectures.

Roll out a pilot program first, making sure security issues and user expectations are worked out before distributing email access organization wide.

Decide on the level of security needed as some networks offer end-to-end encryption, while others go through third-party gateways or are converted, and thus may be less secure.

Use filters to help with the e-mail load as sometimes even simple delineating between read and unread messages can save time and money; prioritisation rules also can be used.

Training is important, but those experienced in e-mail should have no trouble picking up the wireless element, so keep it short and don’t plan too much.

Expect help desk calls to increase, especially as the service is rolled out. Common complaints are security lockouts or issues related more to the wireless service (e.g., delays and holes in coverage) than organization issues.

Limit the number of mailboxes per user. Supporting e-mail from multiple sources is complicated enough.

CONCLUSION

While the potential of wireless emails is not fully realised, the indications are that by 2005, vendor applications will appear in the market making wireless emails a common feature of communication. However, the management of messages and hardware devices is identified as a problem in the area of wireless emails. This problem provides initial doubts in the area of ad hoc collaboration, which is claimed as one of the major strengths of wireless applications. When there is an impediment to this ad hoc collaboration, an organization may find it difficult to realise the concepts of data integration. Without proper data integration using wireless emails, achieving success becomes a problem. Therefore, organizations should take necessary steps to ensure that data is properly integrated and ad hoc collaboration is appropriately facilitated to realise benefits.
REFERENCE


In a globalised economy the labour force has two things to offer, low wages or a well-educated and highly qualified manpower. Therefore in countries like Australia the development and growth of higher education as a “product” is critical. Australian universities have recognized this and so have started to move towards becoming international knowledge producing units and undertaking a larger role in society by participating in and contributing to the stimulation of the economy and its growth (Pellert, 1998). Furthermore Clark (1998) argues that global forces create another level of demand on universities who have to deal with factors such as fluctuating funding sources, changing policies of governments, and varying perceptions of universities as workplace trainers and places for the socially upwardly mobile. In addition, universities not only compete with other universities internationally but with knowledge producers in other segments of society.

In this changing environment, it is argued because universities have to achieve contradictory goals, such as universities have to do more with less money and they have to maintain a cultural heritage while meeting a high demand to develop new fields of study and thought, that an entrepreneurial response by universities offers a better chance to control their own destinies (Burton-Jones, 1999).

THE CHANGING LEARNING ENVIRONMENT

Tsichritzis (1999) observes that it is tempting for universities to see the current economic climate and ‘globalisation’ as temporary, and so defend the existing structures and roles, and wait for better days. Nevertheless, Tsichritzis insists that there is an increasing need for an attitude of ‘life-long learning’ in relation to further education and professional development training to accommodate the changes in the work environment. Thus, universities – once designed for a captive market of somewhat elite cohorts of post-secondary school students – have to address the changing spectrum of student profiles (older-age students, international students and professionals). In addition, Twigg (1994) argues that physical or manual work and the notion of one career will gradually disappear. He states that forecasters envisage that in an average work life people will have several different careers, each requiring new skills, new attitudes and new values, and retraining will be constant because the ‘technology’ of each profession will be changing rapidly.

It is also predicted that those participating in learning and training will not always be able to attend classroom sessions, but will be best taught in the workplace – on the factory floor or in the office, out at sea, and in the home. Learning will not always take place with books, overhead projector or a whiteboard. Learners will use tools such computers and all the accompanying software applications and Internet communication technologies, cable television, video-conferencing and CDs to name a few.

The ensuing outcome means that academics will require skills in using computers in order to teach in new learning environments. Furthermore, because the student cohort has changed, academics will be teaching to students who have a range of learning needs because of their varied backgrounds, ages and stages. Thus, academics will need to go beyond the traditional classroom lecture and explore the range of computer based educational materials, to accommodate the different learning environments and learning arrangements (Twigg, 1994; Bastiaens, T.J., & Martens, R. L., 2000).

THE CHALLENGE

The challenge then is: how do universities in the context of a dynamically changing global environment, who are increasingly needing to be entrepreneurial and business-like, and increasingly using computers in education and the accompanying automated administration systems, support their students and staff, to learn, work and live with computers?
It is suggested in response to this challenge, a systematic and coordinated training approach to support staff and students is taken (Mulholland & White, 2000). One of these approaches is the use of online computer based training materials, as it is accessible and easy to use (via an Intranet for example), it can support current training courses and can complement any computer training embedded in tertiary subjects. It also resolves many of the issues inherent in more traditional education paradigms. The most apparent is its ability to:

- distribute information both locally and globally
- provide flexibility, that is students and staff can study at their own pace and in their own time
- provide additional features such as electronic mail, bulletin boards, different types of media delivery and automated testing
- incorporate an administrative system for monitoring and tracking student progress.

Online computer-based training offers many advantages, however selecting a suitable product or package in the face of reduced training budgets and a myriad of companies and products is the next major hurdle. The following aims, assumptions and scope were put forward as guiding principles for a business case to develop a procedure to evaluate online training packages.

**BUSINESS CASE – GUIDING PRINCIPLES**

**Aims**

The aim of the procedure developed for evaluation of on-line computer based training packages was for its potential to enhance computer literacy and competency and its ability to deliver benefits to university students and staff, and so support the university’s strategic directions.

**Assumptions**

Evaluation of online computer based training to be based on the assumptions that it be:

- learner centred
- easy to use and accessible – on and off campus
- structured
- modularised
- project based
- is able to support ‘just in time’ learning
- maps onto an accreditation procedure, such as the International Computer Driving License (ICDL) or similar
- has either an administration overlay that is built in or is compatible with a package that can monitor and track:
  - Usage
  - Assessment results and learning
  - complements the current face-to-face training
  - meets budget goals
  - provides an environment where learners can practice and rehearse new skills
  - has training materials that are current with current/conventional software packages

Lastly, ‘if it doesn’t teach, it has no value’.
Scope

Defining the extent of the procedure included exploring the different types of training courseware packages available. It was discovered that there are three main categories of technology-based training courseware: entertainment, subject matter and skills. Skills-based training courseware was chosen because it seemed the more appropriate for the aims of the evaluation, it combined content and technology, and provided content for a learner to practice the skill and so be able to apply it effectively (L'Allier, 2000).

The overseeing committee also agreed that the evaluation should focus on the following aspects:

- structure and appearance of the courseware
- usability test results from users (pilot)
- assessment of learning effectiveness and productivity
- cost effectiveness of the product.

EVALUATION PROCEDURE

Introduction

Evaluating software for learning and teaching has a history of using conventional approaches, such as checklists of varying descriptions. Squires and Preece (1999) argue that checklists are seriously flawed in principle because they do not encompass a consideration of learning issues. Further, checklists can be too simplistic and so evaluation questions and methodologies become inappropriate, there is also a lack of validity and of being too narrowly focused (Mulholland & White, 2000). In addition, the ability of checklists to predict educational issues in all but a naive and superficial way has been questioned by several researchers. On the-other-hand, attempts to apply more complex evaluation procedures are excessive and tedious to apply (Squires and Preece, 1999).

Squires and Preece (1999), who are currently researching and developing a set of 'learning with software' heuristics, propose that there is a relationship between the Nielsen (2001) heuristic evaluation principles and a predictive evaluation tool that takes into account both usability and learning issues.

In this case the procedure that was proposed for this university attempts to combine the ideas and principles of both Mulholland and White, and Squires and Preece. Though, it is primarily based on a model designed by Mulholland and White (2000) from the University of South Australia. The model has three phases — planning, conducting, and reporting of results. The key feature is the emphasis on stakeholder involvement, so that all parties who have an investment in the outcome of the evaluation are included and involved in the process, from beginning to end, to ensure ownership and responsibility of the procedure. The model has three phases. The first phase is the planning aspect of the evaluation process and includes the establishment of goals, methodology of choice, scope definition, consultation with stakeholders, and documentation procedures. The second phase is the actual evaluation, and includes the application of the procedure and documentation. The third phase is reporting, and includes the methodology to minimize bias of results and maximize usability of results, the distribution of the actual report findings to all interested stakeholders and their input, and means of marketing and distributing the report across the organization.
For the purpose of this paper the actual evaluation procedure proposed for this university will be described and has six components:

administrative requirements
technical quality
usability testing of the online environment design
expert evaluation of educational design and content
user evaluation of educational materials
long term surveys for computer training managers and academics

1. Administration requirements

The administration section was a form to be completed by the facilitator of the evaluation procedure. The aim of the form was to gather information about each of the companies and included questions such as:

is it compatible with current network capabilities?
can it monitor usage by learners?
is there marketing and publicity support available from the company?
can it be made part of performance appraisal system?
are there inbuilt privacy and security policies?
is there a maintenance agreement?
what access is there to support services?
what is the retail price, and optional extras prices?
what is the manufacturer’s reputation?
are there preview copies available for pilot testing?

2. Technical quality

The technical section was a form to be completed by a computer technician. The data gathered to form a technical baseline, and includes questions such as:

what are the platform and operating system requirements?
does it have the ability to import / export information captured with other authorware and digitizing devices?
is the program reliable in normal use?

is the program ‘bug free’ and, ‘crashproof’ for the student user?
what are the error messages - are they appropriate?
does the program run without unduly delays (loading graphics, for example)?

3. Usability testing of the online environment design

Usability testing is an essential investigation into whether an application is performing the functions for which it is designed. Usability testing for an online application indicates if there are major or minor problems in the design and whether students and staff are able to use the materials. Tests can be conducted one-on-one or in small groups. The tests may take place in a formal lab or in a more typical environment like home or work. The usability testing methodology proposed was based on the work of Nielsen (2000, 2001) and Pearrow (2000) and consisted of a performance test of the software package to gather data via direct observation of how the package is used, ‘verbal response’, and post-test qualitative questionnaire.
4. Expert evaluation of educational design and content

Expert evaluation from online educational authorities is to be sought within the university. A form was designed to assist gathering their feedback, and included questions such as:

- is the program well constructed and designed?
- are the screens clear and acceptable to users?
- is navigation easy?
- are instructions clear?
- can the user exit easily?
- does it include feedback as you learn/participate?
- is the program free of technical quirks and ‘glitches’
- is the information relevant and up to date?
- is the instructional design up to date?
- are the course objectives clear?
- do the activities in the courses give sufficient practice and feedback?

5. User Evaluation of educational materials

A sample group of students was proposed to test the different training modules and rate them for ease of learning, time required to work through each module, and if they ‘liked’ the training packages or not.

METHODOLOGY

The evaluation consisted of a performance test of the software package to gather data via direct usage of the package with ‘verbal response’, and a post-test questionnaire. The test to have four components, as detailed below:

1. Participant greeting and background questionnaire

Each participant to be greeted, offered a seat and a complimentary drink, consent gained and each asked to complete a background questionnaire. Participants advised that they would remain anonymous throughout the testing and subsequent reporting.

2. Orientation

The participants to be read a short orientation script by the test facilitator.

3. Performance Test

Participants undergo a performance test. Each course/module is introduced by way of a short scripted introduction by the facilitator, who also sets the computer at its starting point. Each course/module is worked through by the same participant for each company. An observer records comments, questions, difficulties encountered and time taken to complete each module. There to be five individual results for each course/module.

4. Post-test Evaluation questionnaire

On the completion of the test, participants to be asked to complete a post-test.
5. Suggested long term surveys

The various training applications would be evaluated (as described above) a package would then be selected and implemented. It is suggested that following this, ongoing surveys of training satisfaction be measured (of students and staff) via the inbuilt software administration system. The training application will also be evaluated by training managers and academics (who use the online training packages inside their subjects), on a regular basis. The following is a suggested list of questions for that purpose.

A. Survey Questionnaire for IT Training Managers

do staff/students like online training?
did staff/students acquire knowledge & skills?
did staff/students apply new skills or knowledge on the job or in their studies?
is it cost-effective and effective, as made out to be?
could the same result be achieved more cheaply and/or differently?
do staff/students enjoy this approach?
do staff/students rate it as high quality?
are staff/students motivated to learn more?
is feedback built in, re the program and approach?
does it engage the staff/students?
does it encourage collaboration/learning environments?
does it meet clear educational, life, and organisational strategic goals?
did the application of online computer based training materials increase productivity in their work and/or studies: volume? speed? accuracy? quality?
does it reduce the number of Help Desk calls?

B. Survey Questionnaire for academics re Online Training

what do students need to improve their computer skills?
would they recommend online computer based training materials?
does online computer based training materials stimulate discussion, further learning?
do they like using online computer based training materials and would use it again?
can the learning be measured?

CONCLUSION

Universities are increasingly operating as businesses, and use computer based administration and education systems to meet strategic and quality assurance goals, and teaching and learning objectives. As a result, ongoing computer-based skills’ training is required to support students and staff to study and work in an online environment. Online training packages offer a comprehensive and systematic method for delivering training across single or multiple campuses. However, as they are expensive to implement and maintain, choosing a package to suit the individual needs of each university requires a framework to aid the decision-making process. The procedure proposed is a compilation of the results from two other universities and usability testing methodologies. The model proposed will be studied on a pilot basis to test the efficacy of the methodology, and the results to form the basis of the next stage of the work.
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A Framework of Security Authentication for Internet Banking

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ABSTRACT

The advent of Internet Banking has shown the importance of effective method of authenticating a user in a remote environment. There are many different countenances to contemplate when examining Internet based security. One of the most tried and trusted techniques of protecting the safety of systems and data is to control people’s access. The foundation for such measures is authentication. Specifically for Internet banking there is a real need for a way to uniquely identify and authenticate users without the possibility of their authenticity being cloned. This paper proposes a framework concerning how to identify security requirements for Internet Banking.

Keywords: E-Commerce, Computer Security, Internet Banking, Authentication.

INTRODUCTION

E-commerce fundamentally focuses on the electronic exchange of information using information and telecommunication infrastructures (particularly the World Wide Web and the Internet). E-commerce encompasses a wide range of commercial activities that can be categorised into business-to-consumers and business-to-business sectors. Industry sectors such banking have openly embraced E-commerce to improve their performance and gain a strategic competitive advantage. But many customers are wary to bank through their computer. Hardly a month goes by without the launch of an Internet bank. Some are new banks while others are the descendants of well-established banks. The new banks promise a lot. They are built on advanced and secure technology so customers can bank with total confidence and promise security consumers can trust and are concerned how safe is on-line banking?

However there have been numerous incidents that point to gaping security holes.

When online bank Egg upgraded its website in May 1999, new security measures scrambled online session protocols and allowed users to see banking details of other customers (BBC 2000).

In November 1999, the UK Halifax bank suspended its online share dealing service, after an attempt to fix a bug backfired. Again, account details were made available to other users (BBC 2000).

Barclays, which claims to be the UK’s largest online bank, had to take down its Web site at the end of July, when customers were served the bank statements of other clients (Knight 2000a, Knight 2000b).

Western Union, part of Atlanta-based electronic payments giant First Data Corp., implemented a new Internet-based person-to-person payment service but the site was hacked during a routine maintenance operation that erroneously left parts of the site exposed (Creed 2000). A report by Associated Press detailed how hackers broke in and copied the credit card and debit card details of 15,700 Western Union customers who use the site to transfer funds across the Internet (Guterman 2000).

This paper is concerned with the service of Internet Banking and the issues surrounding authentication, which is the mechanism at the heart of E-commerce security. The content draws a correlation between the concepts depicted in figure 1, by presenting a framework that when applied to certain Internet Banking scenarios can offer...
the customer guidelines regarding the implementation of appropriate authentication mechanisms to ensure an adequate level of trust between the parties conducting the transaction.

![Diagram of security issues in Internet Banking]

**Figure 1: Security Issues of Internet Banking**

**THE FRAMEWORK OF AUTHENTICATION FOR INTERNET BANKING**

The proposed model for identifying security requirements in an Internet Banking environment is intended to support the use in both business-to-business and business-to-consumer E-commerce. Organisations, small to medium sized enterprises (SME's) and home-based customers shall be able to use this framework as a guide to identifying the security requirements for their particular banking environment. The objective of the scenario presented is to encourage a sense of confidence in the parties involved in undertaking Internet Banking transactions, such that there personal information is protected from prospective security breaches, alike to when Barclays, which claims to be the UK's largest online bank, had to take down its Web site at the end of July 2000, when customers were served the bank statements of other clients (Knight 2000a, Knight 2000b).

**Steps in the Framework Process**

Traditionally security assessment has been undertaken by applying conventional risk analysis methodologies. These have become inadequate with the advent of open, distributed networks, requiring new approaches to risk assessment. Thus, the following framework aims to identify the security requirements for an Internet Banking environment. Developed from a framework for E-commerce security (Labuschagne, 2000), it consists of a defined six-step process.

- **Step 1** List all the security requirements for an Internet Banking environment in general;
- **Step 2** Identify all participants and stakeholders involved in the Internet Banking process;
- **Step 3** Break down transactions into different autonomous actions;
- **Step 4** Map these identified actions onto the participants involved, which serve as a model for the Internet Banking environment;
- **Step 5** Use the information obtained in step 4 to determine the security requirements for a secure Internet Banking environment and
- **Step 6** Use these security requirements to develop the security architecture, comprising suitable security procedures, mechanisms and policy.

Each one of these steps is further examined in the following sections.

**Security requirements for an Internet Banking environment in general**

The close relationship that exists between E-commerce and Internet Banking means that an Internet Banking session must satisfy the same security requirements as listed below:

*Identification and The ability to uniquely identify a person or entity and to prove authentication such identity:*
**Authorisation**  The ability to control the actions of a person or entity based on its identity;

**Confidentiality**  The ability to prevent unauthorised parties from interpreting or understanding data;

**Integrity**  The ability to assure that data has not been modified accidentally or by any unauthorised parties;

**Non-repudiation**  The ability to prevent the denial of actions by a person or entity;

**Availability**  The ability to provide an uninterrupted service;

**Privacy**  The ability to prevent the unlawful or unethical use of information or data;

**Auditability**  The ability to keep an accurate record of all transactions for reconciliation purposes.

These eight security requirements have been proposed as the basis for the E-commerce security framework (Labuschagne, 2000). To extend on this, authentication mechanisms need to be incorporated to provide the cornerstone of authentication for the Internet Banking framework. This would comprise the use of passwords, smart cards and possibly biometrics.

The following section describes where these security requirements fit into an Internet Banking environment.

**The Internet Banking Environment**

There are three main areas of security that are involved in Internet Banking. These are:

- The Bank;
- The Internet;
- The User’s (customer) Computer.

The user’s computer includes both a home customer as well as organisational customer using Internet Banking facilities.

The interaction between bank-to-bank Internet Banking has been omitted due to the discrepancy of different and advanced level of security provided at this level.

Figure 2 illustrates a simplified version of the Internet Banking transaction process through an Internet Banking environment where a customer/business wishes to pay a bill.

![Figure 2: Internet Banking environment](image)

In figure 2, there are two participants to any Internet Banking transaction, namely the customer that can either be home or business based and the bank. The important considerations like taxation and legislation across geographical borders have been omitted from the discussion for the sake of simplicity.
DESCRIPTION OF THE SPHERES

Four spheres can be determined from figure 3. Each has its own unique security requirements based on the Internet Banking requirements outlined later. A sphere is defined as an independent entity consisting of a person, information technology or both. Figure 3 shows a representation of these spheres.

Figure 3: Spheres within Internet Banking environment

The following section defines and describes each individual sphere within the Internet Banking environment as depicted in figure 4.

Sphere 1 – Home based Customer

This customer can be any home based user on the Internet. It is therefore not viable to determine or assume that such a customer has any security (authentication) mechanisms in place. The only assumption that can be made is that most home-based customers would use browsers that support digital certificates and the Secure Socket Layer (SSL). However it cannot be presumed that these customers have the knowledge or understanding of how to use this integrated functionality.

The nature of Internet Banking is such that the majority of home-based Internet users should be seen as potential customers and hence should not be prevented or hindered in any way from participating in an Internet Banking transaction. Thus for these customers, the partaking in an Internet Banking transaction should cater for secure and user-friendly operations in a convenient environment.

Sphere 2 – Business Based Customer

This customer can be any business-based company on the Internet. The major difference between a home-based and business-based customer would be the implementation of some form of security mechanisms.

There are two distinct relationships that exist in this instance. Firstly the association of the business-based customer with the bank that represents a similar relationship as a home-based customer and secondly where the business-based customer acts as the merchant between the home-based customer and the bank. In the second scenario, the merchant accepts the responsibility for securing the transaction with the home-based customer before forwarding it to the bank. The merchant must, therefore provide assurance that an electronic transaction can be made safely and securely and that the risk has been minimised to an acceptable level for all participants.

In terms of the nature of Internet Banking, business-based companies are entitled to the same inclusions as home-based banking.

To maintain a level of simplicity, the electronic business environment, which comprises knowledge management and workflow, does not form part of the proposed framework, although it would be possible to adopt the framework for this environment.
Sphere 3 - Bank

The framework regards the inter-network of banks as a single body as opposed to each bank being its own separate entity. The purpose of the banking sphere is twofold; firstly to validate customers through authentication mechanisms and secondly to authorise and honour transactions to ensure against non-repudiation.

Sphere 4 - Internet

The Internet is considered to be a network of networks where there is no one single entity responsible for security or held accountable for any losses suffered. It is viewed as the infrastructure that facilitates global communication, leading to E-commerce and now Internet Banking. From its outset, the Internet in no way has existed to protect any of the participants but rather to provide a channel to facilitate the connection between different entities wishing to communicate via electronic means. Despite version 6 of the Internet Protocol (IPv6) being successfully proven in various test environments, version 4 (IPv4) is still the chief Internet protocol. Adversely IPv4 is absent of the security functionality included within IPv6. Thus, the security of a message cannot be taken for granted.
AUTONOMOUS ACTIONS CONTAINED WITHIN THE INTERNET BANKING TRANSACTION

Up to now the participants and the relationship between them have been explained. The next step is to analyse and divide the transaction into smaller, autonomous actions that combined make up a complete Internet Banking transaction. A typical Internet Banking transaction consists of the following actions as illustrated in figure 4.

Note that home-based and business-based customers are interchangeable.

![Diagram of autonomous actions contained within Internet Banking transaction](attachment:diagram.png)

**Figure 4: Autonomous actions contained within Internet Banking transaction**

- **Action 1:** A customer uses the Internet to connect to their bank’s Web site;
- **Action 2:** The customer browses the Web site and decides on a service. An Internet Banking transaction is initiated by the customer by providing both invoice and payment information;
- **Action 3:** The bank checks if the transaction is executable by verifying the customer has enough funds available and a reply is returned to the customer;
- **Action 4:** Upon completion of the transaction confirmation is sent to the customer;
- **Action 5:** The bank honours the payment and returns proof of having done so.

These transactions could be broken down further if deemed necessary. A decision table can then be used to assist in the identification of the essential security requirements for the Internet Banking environment as previously described.
SECURITY DECISION ANALYSIS

The decision table as shown in table 1 illustrates an example based on the scenario outlined previously. A brief discussion of the steps to develop such a decision table is also provided.

<table>
<thead>
<tr>
<th>Spheres</th>
<th>Step 3 Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer X X X</td>
<td></td>
</tr>
<tr>
<td>Internet X X</td>
<td></td>
</tr>
<tr>
<td>Bank X X X</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Security requirements</th>
<th>Step 4 Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification &amp; authentication</td>
<td>X X</td>
</tr>
<tr>
<td>Authorisation</td>
<td>X</td>
</tr>
<tr>
<td>Confidentiality X X X</td>
<td></td>
</tr>
<tr>
<td>Integrity X X X</td>
<td></td>
</tr>
<tr>
<td>Non-repudiation X X X</td>
<td></td>
</tr>
<tr>
<td>Availability X</td>
<td></td>
</tr>
<tr>
<td>Privacy X</td>
<td></td>
</tr>
<tr>
<td>Auditability X X X</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Decision Table

Following is a brief description of each of the steps.

Step 1: consists of listing all the security requirements that must be satisfied as discussed previously;
Step 2: consists of listing the spheres that have been identified. Only the three spheres shown in figure 3 are used i.e. bank, Internet and customer, whether home or business based;
Step 3: comprises listing the actions that make up a transaction. The five actions previously identified are used in the decision table;
Step 4: maps the actions onto the spheres identified in step 2. Naturally not all the actions will include all the spheres;
Step 5: associates the security requirements for an individual action.

This information is then applied to establish how it can be implemented within the relevant sphere.

In the decision table, action 1 shows that the bank must be able to identify and authenticate a customer satisfactorily to perform a transaction. At the same time the customer wants privacy regarding the personal account information being viewed. Privacy in this context refers to this information being unavailable to other parties. Actions 4 and 5 require the bank to send confirmation of the transaction and to ensure confidentiality and integrity of this message. Concurrently, the customer wants a guarantee that the bank cannot later deny that the transaction took place. This refers to the security requirement of non-repudiation. The table also indicates that the bank needs to record the transaction correctly in order to meet auditing requirements.
By looking at the security requirements for each action, it is possible to identify the security mechanisms required to secure the Internet Banking environment. For action 1, the identification and authentication security requirement could very well be facilitated by the implementation of a smart card authentication system possibly with an accompanying biometric mechanism. The required infrastructure through developed standards and technological know how has already been established for smart cards, providing certain support for this initiative. The security requirements for action 2 might suggest that SSL be used for securing the communication session (currently being used with 128-bit encryption) across the Internet. This may only be an interim approach or for the long term, depending on the implementation and widespread adoption of version 6 of the Internet Protocol (IPv6). Nevertheless it would be imperative to conduct timely checks on the protection provided by 128-bit encryption, with the high likeliness that it will be broken in the near future. The security requirements for actions 4 and 5 may be satisfied using SSL, although the acknowledgement needs to be digitally signed by the bank to conform to the security requirement of non-repudiation for all transactions. This would be catered for by the use of digital certificates.

VALIDATION

For the purpose of this demonstration, the following provides an evaluation of one of the identified scenarios based on the developed framework constructed previously.

The first evaluation is based on the consumer-to-business E-commerce environment depicted in figure 5.

![Figure 5: Scenario 7 Consumer (Cell Phones, PDAs)](image_url)

In this scenario the areas that must be secured include:

- The consumer;
- The terminal (cell phone or PDA);
- The wireless and public network (telecommunication exchange);
- The Internet (communication server) and
- The Bank.
This is represented in figure 6 below that also illustrates the autonomous actions contained within this particular environment.

![Diagram of autonomous actions](image)

**Figure 6: Autonomous actions contained within the cell phone, PDA scenario**

Following is an explanation of these actions.

- **Action 1** - The consumer uses a mobile phone or personal digital assistant (PDA) to connect to a wireless or other public network.
- **Action 2** - Through the telecommunication exchange and Internet, the consumer is able to connect to their bank’s Web site.
- **Action 3** - The consumer browses the Web site shown on their cell phone or PDA screen and decides on a service; i.e. Transfer funds from account A to account B.
- **Action 4** - The bank checks the validity of the consumers’ request.
- **Action 5** - The bank sends the confirmation to the consumer upon completion of the transaction.
- **Action 6** - The bank honours the transfer and returns verification to the consumer.

From this the decision table can be derived as shown in Table 2.
Step 3
Actions

<table>
<thead>
<tr>
<th>Spheres</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
</tr>
</thead>
<tbody>
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<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell Phone, PDA</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wireless &amp; other works</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bank</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Security requirements

| Identification & authentication  |    | X  |    |    |    |    |
| Authorisation                    |    |    | X  |    |    |    |
| Confidentiality                  | X  | X  | X  | X  | X  | X  |
| Integrity                        | X  | X  | X  | X  | X  | X  |
| Non-repudiation                  | X  | X  | X  | X  |    |    |
| Availability                      | X  |    |    |    |    |    |
| Privacy                          |    | X  | X  |    |    |    |
| Auditability                      |    |    |    |    |    | X  |

Table 2: Scenario Decision Table (Derived from Table 1)

By viewing the security requirements for each action, the security mechanisms required to secure this Internet Banking environment can be suitably determined. For example confidentiality can be assured by a smart card acting as a veritable lock between the secret code on the chip and the unsecured terminal (in this case the cell phone, PDA, and telecommunication exchange) environment. In addition authentication can be provided for via the use of a PIN as well as an integrated digital signature and digital certificate associated with a smart card system. Further data integrity can be catered for via the use of Message Authentication Codes that are in-built into the Secure Socket Layer (SSL), which can be used for securing the Web session over the Internet. To prevent Internet based users from breaching the banking network, a firewall should be implemented to isolate the Web server from the customer information database.

Finally, by complementing the identification and authentication process of Internet Banking based transactions with technologies like public-key cryptography, digital notary and digital signature, repudiation of transactions is protected.
CONCLUSION

The entities involved in the transaction including the technological components are clearly defined and arranged accordingly. Naturally the various entities will require different security requirements based on their interaction within the specified Internet Banking environment. The model caters for this determination by providing a detailed decision table that amalgamates all the information gathered in the six-step process. This valuable cross-referencing method ensures that all avenues from whence contingencies arise are covered.

The framework of authentication for Internet Banking allows customers to work their way through each step, identifying the necessary security requirements along with the counteracting authentication mechanism. The distinctive style of the framework including explicit descriptions, examples and cross-referencing capability ensures all security requirements and authentication mechanisms are sufficiently identified for correct and effective implementation.

REFERENCES


Security Issues of M-Commerce

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ABSTRACT

The advancement in wireless communication and economical, portable computing devices has made mobile computing possible. This paper explores the new era of e-commerce, now being commonly referred to as mobile commerce or m-commerce. Firstly the current stance and future outlook of this new commerce initiative is presented along with key mobile technologies that are providing the backbone for the mobile services on offer. For businesses to remain competitive and merge m-commerce with existing business activities, means dealing with implications such as cost, usability and security, which are defining the uptake of the new tools that are enabling m-commerce. This leads to discussing the critical security issues pertaining to a mobile commerce environment.

Keywords: M-Commerce, Security.

INTRODUCTION

Information access any time, anywhere, any place. While e-commerce provides access to anyone at any time, m-commerce provides the next dimension, with access to anyone from anywhere. M-commerce applications are suspected to span from simple banking on the move to enabling financial settlement for every e-commerce transaction undertaken via a user’s portable device including insurance, loans and credit services as well as stock broking and transactional financial trading facilities. Mobile devices will become truly ubiquitous when they embody speech recognition technologies and operate over the new high bandwidth third generation networks (Dennis 2000).

The impact of proficient security in a m-commerce world can be gauged from a recent survey that showed 80% of respondents felt that security and usability were the issues requiring the most urgent treatment with technologies such as the Wireless Application Protocol (WAP) (IT-Director.com 2000c). Another survey suggests people are not exactly overjoyed at the prospect of the wireless Web. The majority of the 1700 people queried revealed that they either would not use or would not pay for m-commerce or m-services. Among those who do not own cell phones, 56 percent indicated their unwillingness to do so. Among those who own cell phones, 48 percent expressed similar resistance. Although the survey did not reflect total opposition to using the Web via a cell phone or a personal digital assistant (PDA), with just less than half of the respondents telling they would use their phones to check email or read news, the immediate future of m-commerce looks grim with only 10 percent saying they would make retail purchases on the wireless web and fewer still indicating their willingness to conduct stock trades (Lindsay 2000).
MOBILE SERVICES

The successful services facilitated via the wireless Internet shall reflect the unique characteristics of mobile access. Namely, timely provision of information when it is most relevant, the ability to access information from any location outside of the office and the relating of information to the current location of the user. These comprise both pull services, where the user consciously connects to obtain information as well as push services, where information is provided under predetermined conditions, often using the Short Message Service (SMS) on Global System for Mobile Communication (GSM) networks. Table 1 displays a breakdown of the services with regard to mobile benefits (ARC Group 2000).

<table>
<thead>
<tr>
<th>Timeliness</th>
<th>Remote Access</th>
<th>Location Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email alert</td>
<td>Remote Access</td>
<td>Location Based</td>
</tr>
<tr>
<td>Fax alert</td>
<td>Transport schedules</td>
<td>Weather conditions</td>
</tr>
<tr>
<td>Stock details</td>
<td>Dealing in shares</td>
<td>Transport schedules</td>
</tr>
<tr>
<td>News headlines</td>
<td>Altering travel arrangements</td>
<td>Navigation</td>
</tr>
<tr>
<td></td>
<td>Vertical support for sales staff</td>
<td>Entertainment/dining details</td>
</tr>
<tr>
<td></td>
<td>Unified messaging</td>
<td>Entertainment booking</td>
</tr>
<tr>
<td></td>
<td>Internet access</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Services with Regard to Mobile Benefits.

The most useful services for consumers given cost effective communication prices include obtaining traffic information or email on WAP, as well as the ability to trade online via WAP (Schuenung 2000). The drive for m-commerce will naturally come from meeting the needs and applications of its users, each with different usage profiles (IT-Director.com 2000a).

KEY MOBILE TECHNOLOGIES

The following provides a brief description of the key mobile technologies that are enabling m-commerce (Langley 2000). Some of the related security dilemmas are covered in the subsequent section.

Bluetooth: low power radio technology replacing wires connecting devices such as PCs, printers, palm tops and mobile phones. Data can be exchanged at up to speeds of 720kbps over distances of up to 10m. The security issues of Bluetooth still has to be assessed.

GPRS: General Packet Radio Service is the first implementation of packet switching within GSM, which is essentially a circuit switched technology. GPRS will send and receive data at up to 115kbps and brings IP capability to GSM.

GSM: Global System for Mobile Communications is the pan-European standard for digital cellular networks that has been widely used around the world.

Sim: Subscriber Identity Module Application Toolkit: Sim cards provide users with authentication to access the network. Using the toolkit, the Sim card can be programmed to perform new operations, personalising the phone to the user.

Smart Phones: GSM terminals that enable users to access e-mail, faxes and company intranets. Smart phones have larger displays, QWERTY keyboards and integral software links to services and applications.

Symbian: partnership between Psion, Ericsson, Nokia and Motorola to promote the Epoc operating system for wireless information devices. Symbian partners work to make key mobile standards possible, like WAP, Bluetooth and Java.

UMTS: Universal Mobile Telecommunications System is building on existing GSM infrastructure. UMTS networks will offer true global roaming and are able to support a vast array of voice, data and multimedia services at speeds of up to 2mbps. Commercial UMTS networks are expected from 2001.
WAP: Wireless Application Protocol provides mobile terminals with access to the Internet. This protocol facilitates for narrowband radio channels and the limited displays and functionality of today's mobiles.

Windows CE: Microsoft's operating system for palmtops.

3G Networks: 3G otherwise known as third generation networks will have broader bandwidth, 'always on' internet connections and more sophisticated devices allowing data to be conveyed visually as opposed to in a text-based format. Heralded as enabling true mobile e-commerce, 3G networks will facilitate two-way communication allowing transactions to be conducted online.

Ensuring transaction security and usability while providing multi-browser support, multi-device support and integration with corporate data and applications is depleted with inconsistent service and lack of standardisation across these systems and devices. Despite these technologies having built-in security mechanisms to ensure transactions in transit over the wireless Internet are safe and secure, they still have associated security implications. Even though the Wireless Transport Layer Security (WTLS) protocol, which is based on the Secure Socket Layer (SSL) and Transport Layer Security (TLS) protocols from the Internet, has been included in WAP since the release of version 1.0, none of the commercially available WAP gateways actually implements the security protocol. In effect, there is no security in today's WAP applications with existing products. So far security at the WAP Gateway is mainly based on trust in the gateway operator (Brooks 2001).

FORECASTS FOR M-COMMERCE

M-commerce is accelerating faster than Internet time. In 1999, there were approximately 200 million users, compared with 400 million cell phone users. The natural trend as cell phones become increasingly Web-ready would be that those 400 million cell phone users would add to the growing global base of m-commerce customers (Simon 2000).

The number of mobile subscribers in 1999 (428 million) already greatly exceeds that of Internet users (241 million) and is anticipated to develop to exceed one billion by 2003 (ARC Group 2000). To the majority of this group wireless access to the Internet has proven to be unappealing due to the low bandwidths and high costs of access such that mobile data users only represented 7 percent of mobile subscribers in 1999 (ARC Group 2000). The situation is beginning to turn with the launch of IP based value added services. This does not include Internet browsing, as it is presently known, rather the provision of a package of information services that source their data from the Internet. Figure 1 displays a graph showing a forecast of Internet and mobile subscriber penetration for 2004 (ARC Group 2000).
The demand for m-commerce has been substantiated by a recent report that I-Mode-friendly Japan, despite being in the middle of a recession, was already generating $400 million worth of revenues via mobile phones. It seems that end-user interest in WAP is also high. This was shown in a report produced by NOP in May 2000 that confirmed that one in ten UK Internet users intended to buy a WAP phone within 12 months. This factor is significant given that 65% of those surveyed already owned a mobile phone (IT-Director.com, 2000b, 2000c).

M-COMMERCE SECURITY

Secure m-commerce faces various dilemmas from the size of digital certificates to poorly planned legislation. Specifically problems with mobile technologies, European Union legislation and design issues with interfaces are holding back electronic transactions over the Wireless Application Protocol (Loney 2000). The mere sizes of digital certificates are too large because of the way they are chained together for trust. Fragmentation of security models is also a problem where there are several proprietary solutions with no single standard or framework for secure transactions to work from. The lack of 128-bit security on early WAP phones has also been an issue especially for businesses where 128-bit encryption is a necessity. Other problems exist like in the UK where the Customer Protection (Distance Selling) Regulations 2000 mean that the consumer must be presented with the entire agreement before they can purchase anything (Loney 2000). Naturally it is not practical let alone feasible to effectively display a 20-page agreement on a mobile phone display. With regards to the user interface, keying in passwords can even prove to be problematic especially when manufacturers set up their phones, assuming that the first character will be a capital. There is also the reduced protection caused by the narrow bandwidth, the short identification keys, and the vulnerability of the device itself to theft. Even though keys can be stored on the Wireless Identification Module (WIM)/Security Identification Module (SIM), they are only as secure as the PIN number needed to unlock the phone (Brooks 2001). There is also the risk of transmission leaks. Specifically, the job of base stations is to decipher the digital data from the air before sending it to the rest of the network. In this way, transmissions between base stations and central office switches have little or no security (Brooks 2001).

Although Wireless Internet Devices (WIDs) offer organisations the advantages of greater network connectivity and mobile Internet access, they also pose serious security risks. Exposure from significant security breaches may emanate from two main dilemmas (Johnson 2000). The first is that development of security technologies lags behind the introduction of WID-based operating platforms meaning that there are fewer available security solutions available for WIDs. The result is that security policies and technologies may be unable to be deployed on some or all of the organisation's WIDs. Thus, an unauthorised user (employee, sub-contractor or other 'trusted' insider) may be able to access applications and confidential information for which they do not have permission. The second problem relates to security officers who may well find it difficult learning and deploying security.
policies on such new and complex technologies. Even in cases where security systems have been designed to be compatible with wireless operating systems, security officers may lag behind in their understanding of which security systems can be deployed for the various wireless devices. In order to concentrate on the benefits of technologies like WIDs, rather than their security risks, organisations need platform-independent solutions that can be implemented regardless of the specific network architectures and technologies they are intended to work with.

There is also the issue of viruses. Phones and PDAs are adding scripting languages of their own, which could be very attractive to virus writers. Sun Microsystems last summer announced Java2 Micro Edition (J2ME), a version of the popular language designed for mobile devices. Like its bigger brother, Micro Java lets programmers write applets that will run on any platform, regardless of the underlying operating system or processor. A greater threat than Java is WScript, the scripting language built into WAP. WScript is less secure than Java. WAP gives scripts direct access to telephony functions, designed for applications such as online directory assistance. This means that a virus could work its way through a user's phone book, calling everyone to transmit a copy of itself. Users of the Japanese NTT DoCoMo network have already experienced something like this, thanks to a PC-based virus. For example, the Timofonica worm is written in Visual Basic Script (VBS) and operates under Windows and uses Microsoft's Outlook address book to spread itself via email. It also sends SMS text messages to random mobile phone numbers. SMS itself does not present a virus threat because it is pure text and cannot carry executable code. However, Timofonica exposes the vulnerability of mobile networks to virus attacks (Brooks 2001).

As more users move away from their own desktop and access the Internet remotely, protecting their data against security breaches will once more be a critical issue. The development of smart card technologies in previous systems offers a good grounding for data protection and authentication for surfers on the go, making commerce secure and reliable. However, these implementations have typically required a password or PIN that are too easily forgotten or forged. Also businesses still deal with customers who say 'I didn't do that. Someone else bought it'. The trend is to move towards a biometric system where it is thought that measuring physical characteristics to verify a person's identity offers greater protection in the e-commerce era (Yackley 2000). With biometrics such statements could not be falsified as the physical item belongs only to that person. Biometrics includes voice recognition, iris and face scans and fingerprint authentication. Fingerprint identification is likely to win out over eye and face scans because it is much cheaper and does not carry the same negative connections. PC manufacturers like NEC are currently selling keyboards with fingerprint sensors with prototypes of mobile phones with sensors on the handset in development. Veridicom, a Santa Clara, California company has introduced fingerprint-ID technology with its smart cards. As opposed to digital certificates and other browser-based security measures that just sit on the users computer, Veridicom's Match-on-Card, is arranged such that the fingerprint template remains on the card. This technology that authenticates fingerprints without transferring the data to a PC or cell phone, means that the user is in control of their electronic signature, because it is on their finger. It is expected that the widespread use of smart card biometrics in cell phones will take another two or three years (Yackley 2000).

The arrival of third-generation (3G) cellular networks, wireless application protocol (WAP) and mobile m-commerce further undermines the issue of security on users' personal devices and can used with all major bearers such as CDMA, TDMA, etc. It is imperative to find an effective solution to this matter as consumers are more conscientious about security than they used to be with lack of security being consumers' biggest fear when performing an e-commerce transaction (Gale Group 2000). To combat these security issues, RSA Security has released the Wireless Transport Layer Security (WTLS) protocol, optimised for use over wireless communication networks. Also RSA has unveiled the RC5 encryption algorithm - part of the WTLS specification - to the WAP Forum standards body and partnered with Nokia, Ericsson, 3Com and others involved with wireless devices to embed its BSAFE products in its partners' offerings (Gale Group 2000). Due to the continued development of WAP, the latest security information regarding WAP can be found via www.wapforum.org.
With regard to securing against viruses, F-Secure Anti-Virus for WAP Gateways is the first product that protects wireless communications, transactions and m-commerce from new and emerging vulnerabilities. F-Secure Anti-Virus for WAP Gateways provides protection against malicious code by checking for viruses and Trojan horses in the content to be transferred to WAP enabled devices. The product detects and disinfects WAP-related malicious content transparently and automatically, providing timely updates of malicious code detection activity. By doing this, it proactively protects the infrastructure, users, their terminals and phone bills as well as their sensitive data.

From the perspective of the WAP Gateway, the solution appears as an HTTP proxy as shown in figure 2, making it easy to add content security to WAP and other HTTP-based architectures. The advance virus signature database is specially designed to handle mobile terminal type patterns, while the automatic update feature ensures that the database is always up-to-date (Brooks 2001).

![Figure 2: Representation of anti-virus software within the WAP network.](image)

In tackling this new wireless frontier Hewlett Packard Internet Security Solutions Division has integrated the HP Praesidium VirtualVault into its WAP server solutions. More than 120 banks in 24 countries— with combined assets exceeding $7 trillion—already rely on VirtualVault. Integrated with Nokia and Tantau WAP servers, VirtualVault now protects the WAP server, as well as the Web server, and controls access to back-end applications. As a result, this configuration protects internal resources, transactions, and business relationships from sophisticated security attacks (Brooks 2001).

The trusted WAP solution sits on the border between the outside world and the enterprise to safely connect applications and databases to mobile users as shown in Figure 3. VirtualVault controls all communication between the internal and external compartments. This solution can be deployed in any type of network, including mobile operator and company-specific networks, in a matter of days. In most cases, no changes to legacy systems are needed. For configurations with existing Web servers, the trusted WAP server can be added as a thin layer to this configuration, maintaining the existing investment. Alternatively, a separate WAP delivery channel can be constructed (Brooks 2001).

![Figure 3: The Hewlett Packard VirtualVault](image)
When it comes to the issue of security it seems that the continents are somewhat separated between a cash and credit card society. It is apparent that Americans are not acculturated to smart cards that are more suitably fitted to the European mentality. Similarly it seems that Americans live in a credit society as opposed to Europeans who still prefer to use cash because of their fear of privacy compromises. This apprehension has resulted in lower rates of e-commerce where for instance, in Germany, only 23 percent of Net users made online purchases with their credit cards in 1998 (Yackley 2000). America’s endearment with the use of checks is another obstacle in the growth of wireless e-billing. Notably America is the only industrialised nation where the quantity of checks used actually increases every year (Koller 2000).

CONCLUSION

M-commerce offers much for businesses and consumers alike. Domestically and internationally the trends point to the number of phones sold exceeding PC sales. Nevertheless, even when the much talked about 3G video-capable high-speed phone services are available – which are not expected to arrive before 2005 in the US – Web content on phones will vary a great deal from that viewed on a PC. With legal and standards issues still to be developed, it seems that the phone will augment rather than replace the PC for the time being. The immediate outlook for m-commerce will be dependent on obvious navigation, concise content as well as automated navigation with other channels. The main barrier to success of new technologies and applications built upon them is convincing users to upgrade to next generation services. Like with e-commerce this will not eventuate until a secure level of trust can be established between the user, the technologies and the service provider.
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Virtual Organising in a Floating Production Storage and Offtake Oil and Gas Project

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ABSTRACT

This paper describes a strategy for organising large scale one-off engineering design and construction projects in which major components have to be concurrently purpose-designed and constructed in different parts of the world prior to final assembly on site. In the case of the Floating Production Storage and Offtake (FPSO) facility selected for the development of the CNL oil and gas field off the northern coast of Australia, a combination of co-located and geographically dispersed teams from various participating organisations collaborated using an integrated project information system. The experience of this project suggests that the establishment of the requisite information systems infrastructure should be supplemented by an infostructure tailored to the needs of the participating organisations. Furthermore, a sympathetic infoculture is required in the participating organisations to ensure commitment to and consistent use of the integrated project information system.

Keywords: virtual organising, integrated project information system, engineering and construction projects, oil and gas, FPSO.

INTRODUCTION

New oil and gas fields are continually being brought onstream to satisfy the increasing global demand for energy and to replace the depleting reserves of existing fields. These new fields tend to be located in remote offshore areas. The FPSO arrangement is a popular method for developing such remote offshore fields, particularly those located in deep water.

A typical FPSO comprises a ship-shaped hull which provides oil storage and supports process facilities on its deck, as shown schematically in Fig. 1. The hull weather-vanes around a turret mooring system which anchors it to the seabed. The oil field is drained via a number of subsea wells which are drilled before the FPSO arrives on location. The wellheads and manifolds on the seabed comprise the subsea production system and are connected to the FPSO by a system of flowlines and risers. Fluids from the wells travel along the flowline / riser system and enter the FPSO via special swivels in the turret mooring system.

Gas and water are separated from the crude oil in the process facilities. Some gas is used for power generation and the balance is either flared or compressed and reinjected back into the oil field. The crude oil is stored in the hull and periodically pumped to shuttle tankers that temporarily moor to the stern of the FPSO.

The expertise for designing and building all the major components of a FPSO are difficult to find within one company. The hull and its associated marine systems are usually designed and built by a vertically integrated design and construction team in a shipyard. The turret mooring system is the expert province of a company that owns the technology for the special fluid swivels. Likewise, the
flexible risers and flowlines can only be reliably designed, supplied and installed by a handful of companies worldwide. The process facilities are designed and built to normal oil and gas industry standards with some minor modifications to account for the movements of the FPSO. There is usually an overall control system which links all the major components back to a central control room located in the accommodation block on the deck of the FPSO.

Such projects are generally one-off as the major components have to be specifically tailored to the characteristics of the particular oil field, e.g. well flow rates, fluid composition, pressure and temperature profiles, as well as the site environmental and geotechnical conditions.

Quite apart from the economic pressures to bring every field onstream as quickly as possible, there are also many design interfaces and overall technical integrity considerations linking these major FPSO components which necessitate their concurrent design and construction. Whilst co-location of the design teams is preferred for ease of communication and management, this is often not practicable for FPSO projects because of the geographically dispersed locations of the participating expert companies which may be supporting a number of projects worldwide at any one time.

Although a few shipyards are capable of constructing the hull, process facilities and turret in one location, this is not the usual arrangement. Most oil and gas clients prefer to award construction of the process facilities to fabrication yards with good track records for similar construction for the oil and gas industry. There is also the usual reluctance to place “all the eggs in one basket”. The turret mooring system, including the fluid swivels, is often provided as a design-construct package by the expert company. Other specialist suppliers provide the flexible risers, flowlines and overall FPSO control system.

Hence, a FPSO oil and gas project presents the challenge of successfully organising a large scale one-off engineering design and construction project in which major components have to be concurrently purpose-designed and constructed in different parts of the world prior to final assembly on site.

One solution to this problem is to use a combination of co-located and geographically dispersed teams from the participating organisations who collaborate using an integrated project information system, as illustrated in the following case.

THE CNL FIELD DEVELOPMENT

The CNL field, located in deep water off the northern coast of Australia, was discovered in late 1995. After feasibility studies by the client, Enercorp, the decision was taken to develop the field using subsea wells and a permanently moored FPSO unit.

The well fluids are stabilised on the FPSO and the produced light crude oil is exported through an offloading hose to tandem moored trading tankers. The purpose-built hull is designed for a 20 year working life and has a 1.4 million-barrel storage capacity. The process facilities located on the deck of the hull are designed to handle an oil production rate of 170,000 barrels per day.

Key Players and the Major Contracts

Late in 1996, Enercorp awarded the contract for designing and constructing the FPSO to the Norway Monaco Consortium (NMC) formed by the multinational Norwegian Engineering Company (NEC) and the mooring systems specialist Monaco Mooring Systems (MMS). To shorten the overall project duration, Enercorp negotiated and awarded a contract for design and construction of the hull to Korea Shipyard (KSY) in parallel with its negotiations with NMC. This hull contract was then novated by Enercorp to NMC to manage as part of the FPSO contract.
Within the NMC, NEC was responsible for overall process design and technical integrity of the FPSO. MMS designed the turret mooring system in its Monaco head office and subcontracted fabrication of the system to Abu Dhabi Fabricators (ADF). NEC designed the process facilities in its Norway office and subcontracted fabrication of the key process modules to Australia Constructors (ACON) and the balance to Singapore Shipyard (SSY). Hundreds of purchase orders were also placed by NEC’s project procurement team in Norway for equipment to be incorporated into the process facilities. SSY also won the subcontract for the assembly, hookup and commissioning of the FPSO after delivery of the hull, turret and remaining process modules to Singapore.

Enercor awarded the contract for the design, construction and offshore installation of the subsea production system, flowlines and risers to another consortium, Subsea Flowlines Offshore (SFO). SFO subcontracted the design and construction of the subsea production system to Scotland Subsea Technologies (SST) who carried out the design in Scotland but fabricated the system in Australia. SFO was also responsible for towing the assembled FPSO from Singapore to the CNL field off the northern coast of Australia. The flowlines and mooring chains previously installed on location by SFO were then connected to the FPSO for final commissioning tests and commencement of production in late 1999.

Both NMC and SFO worked closely with Australia Control Systems (ACS), the specialist company engaged by Enercor for the design and supply of the overall control system for the FPSO and the subsea production system.

The FPSO contract hierarchy and contract boundaries are illustrated in Figs. 2 and 3 respectively. This contracting approach was adopted by Enercor to motivate the two main consortia, NMC and SFO, to manage the many interfaces within their respective boundaries of responsibility, in theory requiring Enercor only to adjudicate between them.

Enercor also encouraged SFO and ACS to use NEC’s integrated project information system (IPIS) which was adopted by NMC as a means of coordinating all the concurrent design and construction activities by the combination of co-located and geographically dispersed teams.

The Project Schedule

The original 30-month project schedule was extremely ambitious and partly depended on NEC successfully repeating the fast-track approach based on overlapping design, procurement and construction activities as used on an earlier FPSO project in Norway.

Much of the previous success was attributed to the use of IPIS which integrates design and information management and facilitates the systematic tracking of completion status of the many elements which make up a FPSO.

In the case of the CNL project, practical difficulties were experienced in the implementation of this concept, as elaborated later in this article. This contributed in turn to a significant overrun in the project budget and a 39-month schedule as outlined in Figure 4. It would appear, however, that such overruns and delays are not uncommon for FPSO projects (Rosi, 1999).

The Project Organisation

A Project Manager who reported to the Enercor Project Manager as well as the respective consortium board led each consortium. Within each consortium, the teams were generally organised in a traditional hierarchical structure centred around individual major components, and with access to shared project support services. Interface engineers were located within each team to coordinate technical interfaces with other components. NMC also established a separate team to ensure that overall technical integrity was maintained while design of the components progressed concurrently.
The project kicked off after Enercorp in Australia completed feasibility studies. Enercorp supervisory personnel were then located in contractor design offices in Norway (NEC for process facilities), Monaco (MMS for turret mooring system), Korea (KSY for hull) and Australia (SFO for subsea system and ACS for integrated control system) as the major component contracts were progressively awarded. This trend continued as the fabrication of the major FPSO components started in Korea (hull), Abu Dhabi (turret), Singapore (process facilities and FPSO assembly) and Australia (process facilities and subsea systems). NMC and SFO personnel were also sent to supervise their respective fabrication subcontractors in these countries.

The site teams reported back to their respective consortium design offices. The NMC project management team moved from the NEC design office in Norway to Australia when the design of the process facilities was almost complete. Hull construction was already well advanced by that stage and fabrication was underway on the process facilities in Australia and Singapore. A few NEC design engineers and procurement personnel remained in Norway to complete their outstanding tasks. The SFO design office was located in Australia and liaised with the SST office in Scotland responsible for the design of the subsea production system.

The Integrated Project Information System (IPIS)

As a major engineering contractor in the Norwegian oil and gas industry, NEC has developed a sophisticated integrated project information system (IPIS) to manage the multidisciplinary technical information progressively created in the course of a typical oil and gas project. This information is vital for interface management, project control and maintaining overall technical integrity. It also captures a lot of the information required for subsequent commissioning and operation of the facility.

IPIS integrates computerised design tools and associated database systems into a comprehensive and controlled environment. All common data from the various application systems are uniquely and commonly defined and stored in a core database as shown in Fig. 5. This minimises data duplication, enhances overall data integrity and facilitates the meticulous change control necessary for managing design optimisation in complex projects. The system also enables timely incorporation of as-built or vendor information into ongoing design, construction, commissioning work and ultimately into reference documentation for operational use.

IPIS applications include 3D design, materials management, systems engineering, piping and instrumentation design, project completion and document management. Other non-integrated systems communicate with the common database via a standard import/export interface.

In the case of the CNL Project, IPIS was available to the various design offices and construction sites in Norway, Monaco, Abu Dhabi, Singapore, Australia and Korea via a dedicated project Wide Area Network. The main server was originally located in the NEC office in Norway and subsequently shifted to the NEC branch office in Australia when the NMC project management team was relocated. Fig. 6 depicts the WAN structure after the relocation.

Local Area Networks were also established in each project office and site. Email was used extensively for communication within the project and with other organisations involved in the project.

Use of IPIS was fundamental to the overall management of the CNL project given the many concurrent design, procurement and construction activities taking place all over the world. Interfaces were modelled using the 3D design system and all project documents and correspondence were stored in the document management system. The weight control module was used to track dry and operating weights of all components as this was important for structural design and overall weight control of this floating facility.
However, a number of problems were experienced with the use of IPIS on the CNL project.

One major difficulty was the fact that the system has been developed primarily for NEC work in Norway. The Norwegian oil and gas industry is a close knit community of client, engineering, supplier and construction organisations that have mutually benefited from the long-standing relationships arising from the continuous stream of contracts and orders awarded to local firms over the last two decades. These relationships, which encourage active information sharing and trust, were difficult to replicate in the short term with the other organisations participating in the CNL project who had not previously worked with NEC.

It also transpired that some of the Norwegian industry work practices and interfaces on which IPIS is based were not norms for the other organisations involved in the CNL project.

Most NEC personnel had developed familiarity with IPIS as it evolved over a period of years. However, IPIS proved to be a very steep learning curve for non-NEC personnel on the CNL project—partly because of its complexity and partly because of their lack of familiarity with the way in which information was structured within the system. Ironically, the fact that most personnel used English on the project actually caused a degree of confusion—it transpired that in some cases the same words were being used with (slightly) different meanings!

The very tight project schedule meant limited time and resources for training non-NEC personnel who often had to rely on available NEC personnel to assist them as they learnt to use the system. The staggered commencement of project personnel also meant that there were always new people learning to use IPIS. These problems were particularly acute for the offices and sites outside of Norway.

The one-off nature of the project may also have affected the readiness of some NEC personnel to fully transfer skills in the use of this strategic tool to non-NEC project team members. Likewise, non-NEC personnel may also have been reluctant to invest the significant effort required to master this tool.

Some remote offices and sites also experienced problems with system response speeds, probably due to bandwidth limitations in the local communications infrastructure. Data replication was also an aspect that required frequent attention.

As a result of these difficulties, most non-NEC personnel ended up using only the document management system in IPIS. The relevant data from non-NEC components had to be input into the other IPIS applications by NEC personnel.

The document management system incorporated a sophisticated electronic workflow function which was very efficient in the distribution and tracking of documents, including correspondence, drawings, specifications, reports and vendor data. However, not all project personnel were fully committed to the use of this system—possibly due to the general lack of familiarity of some non-NEC personnel with fully electronic document management systems. The complexity of the document management system also meant that a team of NEC document controllers had to be relocated from Norway to Australia when the main server was shifted with the project management team. It then took several months to transfer the requisite skills before local Australian personnel could run the system.

Non-electronic project information was scanned into the document management system, in theory enhancing the availability of information to all project personnel. However, backlogs in scanning the huge amount of project documentation and inconsistencies in indexing often caused difficulties for personnel dependent on this information for design and construction work.

Apart from email and IPIS, project personnel communicated by phone and fax. Video-conference meetings were held regularly between the project management team and the construction site teams. However, information overload proved to be a problem for key personnel such as the project managers, supervisors and coordinators. This was compounded by occasional overzealous use of the
highly efficient electronic document distribution system to push documents to people who did not really need to review or read the documents.

Despite the problems encountered, it is difficult to envisage how the huge amounts of information that had to be shared “in real time” amongst the geographically dispersed teams (and even within co-located teams) could have been managed without a similar sort of electronic information system. After the FPSO commenced operations, the document management portion of IPIS was retained for retrieval of historical information by the operations team.

CONCLUSION

Oil and gas fields developed using the FPSO approach face the challenge of successfully organising large scale one-off engineering design and construction projects in which major components have to be concurrently purpose-designed and constructed in different parts of the world prior to final assembly on site.

One solution, as demonstrated on the CNL oil and gas field development, involves a combination of co-located and geographically dispersed teams from various participating organisations who collaborate using an integrated project information system (IPIS).

Despite a substantial investment in a sophisticated WAN spanning a number of countries, there were quite a few infrastructure issues regarding bandwidth, response time and data replication that had to be addressed on the CNL project.

IPIS had been developed over the years to suit the design and construction interfaces, procedures and practices in the Norwegian oil and gas industry. Not surprisingly, a number of infrastructure issues arose when shipyards and fabricators in Korea, Singapore, Australia and Abu Dhabi had to interface with the system.

IPIS had previously been used successfully in the environment of active information sharing and trust prevailing in the Norwegian oil and gas industry as a result of business relationships built up over the last two decades. This infoculture did not necessarily extend to the other organisations participating in the CNL project, some of whom were dealing with NEC for the first time.

The one-off nature of the project may also have compounded the problem of IPIS skills transfer, already made difficult by the tight project schedule and limited resources. The end result was that the system was probably not used to its full potential in most areas of the project.

Despite all the problems experienced with the use of IPIS, the author is of the opinion that it was essential to the successful completion of the CNL project. The fact that the FPSO was able to exceed its nominal design throughput shortly after commencing oil production indicates that the complex technical integration of the components was successfully achieved. Furthermore the document management portion of the project information system remains in use today by the Enercorp operations team.

DISCUSSION

The geographical spread of the various companies and teams which combined to deliver this project appears to satisfies the generic definition by (Lawrence, 1998) of a virtual organisation as

’an amorphous entity which is a combination of different companies or individuals that have combined to complete specific projects or business propositions and development’.
Interestingly, the CNL project was formally structured as an integrated hierarchical organisation. However, it was forced to function virtually because of the geographical dispersion of the various design offices and construction sites.

(Marshall, 2000) suggests that integrated organisations are preferred over virtual organisations when

- innovation is systemic rather than autonomous,
- information and knowledge flows are tacit rather than codified,
- ability to resolve conflicts is high rather than low,
- incentives for risk taking are low rather than high.

In the CNL project, innovation was generally systemic due to the complex interrelationships linking the major FPSO components. Change control was a major concern throughout the project duration. Changes were tracked via IPIS and authorised via the project hierarchy.

Much effort was expended in codifying and storing information in IPIS. All contractors were also required by Enercorp to provide specific documentation at various stages of the project eg specifications, reports, manuals, etc. However, design expertise essentially remained tacit, there being little motivation or time available for knowledge transfer. This was also partly true of knowledge regarding IPIS itself.

A large proportion of project management energy was devoted to conflict resolution because of the many interfaces involved and requirement for realistic compromises due to budgetary and time constraints – this was part of the reason for the integrated hierarchical organisation structure.

One side effect of the integrated organisation structure was to discourage risk taking. There was a constant tension between the desire for innovation (including continued design optimisation) and the drive to achieve project budgetary and schedule targets.

It is also interesting to compare and contrast the CNL project with the Virtual Cross-supply chain Concept development Collaborative (VC3) teams used by Boeing-Rocketdyne. In the case study reported by Carman (1999) an 8-person virtual team successfully designed a radically improved thrust chamber for a rocket engine. The team comprised five members from Rocketdyne, two from Raytheon (1000 miles away) and one from MacNeal-Schwendler (100 miles away) – all located in USA. The work was completed over 89 virtual meetings held over a 10-month period.

The main design phase on the CNL project lasted about 18 months. Several hundred people worked on the project. NMC personnel alone peaked at about 250 in Norway, 40 in Monaco, 40 in Korea and 15 in Singapore. Although almost all project personnel spoke English, differences in terminology and work practices did occasionally result in misunderstanding.

NMC, Enercorp and subcontractor personnel were typically co-located as integrated teams at each construction site and communicated with the other project design offices and construction sites via phone, fax, email and video-conferencing. Quite a number of project personnel never met their counterparts in other locations face-to-face during the project and relied exclusively on these communication methods and IPIS for collaboration.

Both the VC3 team and the CNL project used integration tools. The much larger scale of the CNL project required a more sophisticated integrated project information system which was the result of many years of development by NEC and which was regarded as a competitive advantage over its rival engineering companies. The VC3 team used Internet Notebook, an off-the-shelf product.

The VC3 team had the benefit of an existing Continuous Ordering Agreement which had been worked out between the participating organisations over the course of the preceding year. Although NEC and MMS had previously worked closely together, thus facilitating the formation of the NMC consortium.
for this project, the other key players, including Enercorp, KSY, ACON, SSY, SFO, ACS and SST, had not worked with one another immediately prior to this project. The organisations were brought together via competitively tendered contracts and the tight schedule left little opportunity for developing the sort of trust-based collaborative arrangements enjoyed by the VC3 team. This may have affected the commitment by non-NEC personnel to use NEC's proprietary IPIS on the project.

Furthermore, the CNL project was NEC's first major FPSO contract involving relocation of large numbers of NEC personnel outside of Norway. Hence, the interface and information-sharing procedures and protocols had not been previously tested on a project as widely dispersed as this. The tight schedule, transient nature and number of project members would have made it very difficult to formulate coordination protocols in the collaborative manner employed by the VC3 team. IPIS training documentation tended to be quite prescriptive and assumed a degree of familiarity with NEC work practices.

The VC3 team recognised the need to invest a significant amount of time and effort in setting strategy, agreeing technology usage protocols and aligning work processes at different stages of their collaboration. Although resources were allocated to tackle the information communication technology aspects of the CNL project, strategy and work processes did not seem to receive the attention they deserved. NMC project management effort was focussed on solving the more immediate technical and contractual problems.

In their post-mortem, the VC3 team acknowledged that the support of a knowledge manager would have greatly assisted the 8-person collaboration. The CNL project which involved several hundred people would definitely have benefited from a knowledge manager employed by Enercorp to oversee this crucial aspect across all the participating organisations. Instead, the project relied on the support of NEC's corporate information systems management personnel who had developed IPIS. These personnel, whilst expert in NEC's integrated project information system, did not necessarily have the overall project knowledge management perspective or sufficient motivation to understand the culture and specific needs of the other organisations.

SUGGESTIONS FOR FURTHER RESEARCH

More cases could be studied to examine the applicability of this approach to other engineering design and construction projects. This may be influenced by factors such as type of industry, project size and duration, geographical dispersion of project team, degree of overlapping work, contracting arrangements and characteristics of participating organisations. The last factor could include experience of previous collaborative work between and within the organisations, as well as evidence of the requisite skills required to design and manage virtual teams of knowledge workers from different organisations (Grenier, 1995, Chap. 20).

A more detailed consideration of the information flows involved in such complex projects may be worthwhile. Previous work on sequential, design centered, concurrent and dynamic design definition models (Yazdani, 1999) for product engineering could perhaps be extended to such one-off projects. In addition to the challenge of information management during the dynamic engineering and construction phase, there are also whole of project life economic and knowledge management issues to be considered (Jaafari, 2000).

The work by McKay (2000) on the design of interorganisational tools could perhaps be extended to provide specific guidance from the infrastructure, infostructure and infoculture perspectives (as defined in Newell (1999)) for further development of this approach. Much depends on the degree of motivation at organisation, team, and personal levels to invest in setting strategy, agreeing collaborative technology usage protocols and aligning work processes (Carman, 1999) for the benefit of these one-off projects. If the network organisation (Miles, 1994) is the ideal model for such
geographically dispersed projects, is it achievable in practice in the highly competitive oil and gas environment (Rosi, 1999)?

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Fig. 1 FPSO Configuration
(Schematic only)

Fig. 2 Project Contract Hierarchy
Key Project Activities:

- **Design**
  - Norway
  - Monaco
  - Scotland
  - Australia
- **Construct**
  - Korea
  - Abu Dhabi
  - Singapore
  - Australia
- **Assemble**
  - Onshore
  - Singapore
  - Offshore
  - Australia

Major Components:

- **Process Facilities**
  - NMC
  - NEC
  - ACON
  - SSY
- **Hull**
  - KSY
- **Turret Mooring System**
  - MMS
  - ADF
- **Subsea Production System**
  - SST
- **Flowlines & Risers**
  - SFO
- **Overall Control System**
  - ACS

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**Fig. 3 Project Contract Boundaries**
(Schematic only)

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**Fig. 4 Project Schedule**
(Indicative only – to illustrate overlap of major component activities)
Fig. 5 Integrated Project Information System
(Conceptual only)

Fig. 6 Project Wide Area Network
(Schematic only)
B2B E-Commerce and Small Businesses:
A Melbourne Snapshot

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ABSTRACT

This paper examines some of the literature in relation to the use of Business-to-Business (B2B) electronic commerce by small businesses. A survey of businesses in the Melbourne (Australia) region was carried out to see if the issues identified in the literature in relation to the use of B2B e-commerce applied locally. Results showed Melbourne businesses to be consistent with uses and attitudes identified in the literature. Small business respondents had a lower level of document transfer, less B2B awareness and had lower levels of adoption of B2B. Some trends were identified in different industry areas.

Keywords: B2B; Business-to-Business; E-Commerce; Small Business; Melbourne; Australia

INTRODUCTION

Value wise, business-to-business (B2B) electronic commerce is the most significant form of electronic commerce activity. This paper examines some of the literature in relation to the adoption (and non-adoption) of this type of electronic commerce by small businesses. The purpose of this paper is to report on the results of a survey of small businesses in the Melbourne (Australia) region. The study examines whether many of the characteristics identified in the international literature can be applied locally, especially in the areas of small business knowledge of B2B, and the reasons for its adoption and non-adoption.

BACKGROUND

Business-to-Business Electronic Commerce

Straub (1998) defines electronic commerce (e-commerce) as activities that directly support commerce by means of electronic (that is, networked) connections. The majority of external activity currently occurs between one business and another business (dubbed business-to-business or B2B e-commerce (DIST, 1998), and often involves many businesses along the supply chain. An example of this is the supply chain of wholesaler to distributor to retailer to customer, where all of the links are B2B except the one between retailer and customer, which is business-to-consumer (or B2C). B2B e-commerce provides the ability to connect businesses with their trading partners creating new benefits and advantages in the supply chain.
It is estimated that B2B transactions have comprised 80% of all electronic commerce (Conhaim, 1999). This is likely to remain the case in the near future. Some of the reasons for this include (Straub, 1998; Viehland, 1998):

Businesses are generally more computerised and networked than homes

Many businesses only sell their goods and services to other businesses.

The majority of transactions in the supply chain for many businesses goes from business to business.

Supply chain management tools, involving the communication of information such as payment terms, instructions and product details electronically, dominate B2B e-commerce applications. Large retailers are able to remove a substantial part of their inventory carrying costs as purchasing becomes the most popular type of business-to-business e-commerce transaction (Friel, 1999; Conhaim, 1999). Many suppliers are now providing web sites that not only provide these services, but also extra services such as order placement and approval tailored to a particular organisation (Karpinski, 1999). Newer supply chain related B2B activities target just-in-time applications and improved customer response (Johnston, 2000).

B2B Electronic Commerce In Small Business

For the purpose of this study a small business will be characterised as one with 30 employees or less (including managers/owners).

ADOPTING B2B IN SMALL BUSINESS

For more than two decades, B2B ‘electronic’ commerce has primarily entailed large companies building private, proprietary networks to link themselves with business partners (this being known as Electronic Data Interchange or EDI). The internet is providing a more open (less proprietary) approach to B2B e-commerce as an alternative to traditional EDI. Small businesses have been reluctant to adopt EDI as they felt that they could not justify doing business in this manner due to the large investment in software, hardware and telecommunications equipment. Due to the open nature of internet technology, small businesses now have the means to participate in business-to-business e-commerce (Johnston, 2000).

Small businesses may be forced to implement B2B e-commerce just to remain competitive within their industry. Also, pressure from trading partners can force small business owners/managers to adopt B2B e-commerce, by threatening their smaller trading partners into implementing it or risk the termination of the business partnership (MacGregor and Bunker, 2000).

KNOWLEDGE OF B2B E-COMMERCE

When attempting to comply with the push toward B2B e-commerce, small businesses are faced with a typical obstacle of simply not understanding which tools can help them develop a successful solution. Although small business owners, managers and employees are much more technologically savvy today than a few years ago, small businesses mostly do not have the internal resources to successfully manage B2B technology without assistance (Johnston, 2000). As a result small business owners/managers will often seek assistance from e-commerce solution providers. However, the solution providers working with small businesses are becoming more cautious about the e-commerce market. One issue for e-commerce solution providers in the small business market is that many clients fail to pay their bills on time. Another issue for solution providers is the lack of in-house IT knowledge. As a result, e-commerce solution providers are being cautious and more selective about the small businesses they accept as clients. As such, small businesses may be restricted in their choice of solution providers (Rogers, 2000). ‘Successful’ use of IT in small businesses is positively related, however, to vendor service, support, training and expertise (MacGregor and Bunker, 2000), so the incentive is there for small businesses to pursue external expertise where it is needed.

Most advocates of EDI in small business have traditionally just translated the benefits available to larger businesses over to smaller businesses, without necessarily investigating the specific characteristics of smaller businesses (Macgregor and Bunker, 2000). Owners/managers of small businesses which are aware of or involved in implementing and maintaining B2B e-commerce systems therefore need to have current and thorough knowledge of such technology in order to gain optimum benefits from B2B e-commerce capabilities. A small business manager that has limited knowledge of B2B e-commerce may be reluctant to willingly implement such technological capabilities.
REASONS FOR SMALL BUSINESSES NOT ADOPTING B2B

The previous two sections sum up the major reasons why many small businesses have not adopted B2B e-commerce: a lack of knowledge of the benefits it can provide, the cost of the technology and a lack of the skills needed to implement it.

THE STUDY

The purpose of this study was to investigate small businesses in the Melbourne (Australia) region to see if the issues identified in the general literature in relation to the adoption and use of B2B e-commerce in small businesses applied in Australia. It also provided an opportunity for a comparison between different industries within those small businesses to see if any trends were evident.

Population and Sample
The population for this study was drawn from the Australian Melbourne Metropolitan Yellow Pages Directory – 2001 (Telstra Corporation, 2000). The aim was to obtain a sample where at least 75% of the businesses were small. This was initially determined on an ad hoc basis by the selection of only those businesses with a one-line advertisement in the directory (the idea being that mainly small businesses would take out these types of advertisements).

To compare the use of business-to-business electronic commerce throughout the various industries, a stratified random sample was used to include businesses from different industries according to the category they were listed in the directory.

DATA COLLECTION

Data was collected via a four-section questionnaire, distributed by mail. The first section included questions on the general characteristics of the business. Section two was intended to determine respondent’s knowledge of B2B e-commerce. The third section aimed to gather information on various issues targeting those businesses that use business-to-business e-commerce. The last section aimed to gather information on various issues for businesses that have not implemented B2B e-commerce.

RESPONSE RATE

The response rate was achieved after the initial survey was sent out in October 2000 and a follow-up was mailed out in December 2000. The overall response rate was 73 of 140 companies (approximately 52%). This was considered to be a most adequate response rate.

The returned questionnaires have been classified into the following characteristics:
78% of respondents were from small businesses (1-30 employees)
11% of respondents were from medium businesses (31-100 employees)
11% of respondents were from large businesses (101 or more employees)

This distribution meant that the desired proportion of small businesses (over 75% of the entire sample for the study) had been achieved.

The response rate may have been higher but several completed surveys were disregarded as they were returned after the return date specified on the questionnaire cover letter and survey. There were also 13 surveys that were ‘returned to sender’ as the businesses had left the address specified. This gave an effective response rate of 57% (73/127).

Data was analysed using Microsoft Excel.
RESULTS

Business Characteristics of Respondents

INDUSTRY BREAKDOWN

Graph 1 shows that almost 28% of survey respondents were from the retail industry with IT respondents accounting for just over 18% and almost 12% of respondents belonging to the transport/storage industry.

SIZE OF BUSINESS

The sample chosen for this study was primarily focused on small businesses (1-30 employees). As expected, the bulk of survey respondents fell into the small business category. Just over 78% of respondents were employed or managers/owners of a small business. Medium businesses (31-100 employees) accounted for 11% of the results with large businesses (101 or more) also accounting for 11%.
GEOGRAPHICAL LOCATION

Over 80% of respondents owned business establishments in city or suburban areas of the Melbourne metropolitan region.

Graph 3: Geographical location
Characteristics of B2B Adoptions

DOCUMENT TRANSFER

The volume of business document transfer that is required to conduct business may be an issue in the decision to implement B2B e-commerce within the organisation. Respondents were asked to rate their volume of business document transfer using a scale ranging from very high to very low. Upon devising this scale it was considered that what one respondent estimated very high to be might be conflicting with another respondent’s estimation. To overcome this, a number (of business documents) was assigned to each level of the scale.

Graph 4: Volume of business documentation transfer

Although Graph 4 implies a relatively even spread of document transfer across respondents, medium to large company respondents indicated that they have medium to very high levels of business documentation transfer between their suppliers and distributors, whereas the majority of small businesses rated their transfer of business documents between very low and medium.

Small businesses in the retail industry indicated a low to medium volume of document transfer. Transport and storage small business owners indicated a low rate of document transfer with any suppliers and distributors, whereas information technology small businesses tend to have very high document transfer between suppliers and low document transfer rates with distributors. This indicates that business document transfer is not consistent across different industry supply chains. This is likely to affect the level of adoption of B2B e-commerce across different industries.

B2B ADOPTION RATES

The following tables show the B2B e-commerce adoption rates amongst small business respondents.

Table 1: B2B E-Commerce Adoption in the Retail industry

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small business</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Medium-large business</td>
<td>80%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Table 2: B2B E-Commerce Adoption in the Transport & Storage industry

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small business</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Medium-large business</td>
<td>80%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Table 3: B2B E-Commerce Adoption in the Information Technology industry

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small business</td>
<td>77%</td>
<td>23%</td>
</tr>
<tr>
<td>Medium-large business</td>
<td>75%</td>
<td>25%</td>
</tr>
</tbody>
</table>

This result is consistent with that of the previous question. It was also expected that adoption rates would be generally higher in medium to larger businesses than in small businesses. The information technology industry provides an interesting contrast to this.
METHOD OF DOCUMENT TRANSFER

Almost 40% of survey respondents indicated that they use postal services more than any other method of document transfer. Thirty nine percent also stated they use electronic means of document transfer. Electronic transfer was specified as facsimile, electronic mail or the Internet. Courier use is less favourable in small businesses due to the higher cost. All medium to large business respondents stated they use postal service with 56% also indicating they utilise couriers for business documents transfer between trading partners.

Graph 5: Method of document transfer

USES OF B2B E-COMMERCE

Over twenty eight percent of businesses that have implemented B2B e-commerce use such technology for accounts payable and receivable to and from trading partners (namely suppliers and distributors) and other businesses associated with the company. Almost twenty six percent of businesses indicated they use B2B e-commerce for ordering and purchasing with only a further fourteen percent stating they use it for delivery documents of goods or services provided by the business. Businesses that have implemented B2B e-commerce also stated other business activities it is used for:

- Tracking
- Information gathering
- Business documents
- Selling
- Acquire system support files, software applications and upgrades

Businesses in the manufacturing industry indicated they mostly use B2B e-commerce for ordering goods and services and for accounts payable and receivable. Wholesaling businesses typically use the technology for ordering and the purchase of goods and/or services from other businesses. Businesses in the retail and
information technology industry both indicated they mainly use B2B e-commerce for such business activities as ordering, purchasing and accounts payable and receivable. Transport and storage businesses surveyed stated they generally use the technology for purchasing goods/services and accounts payable/receivable.

Knowledge of Business-to-Business E-Commerce

AWARENESS OF B2B E-COMMERCE

It can be seen from Graph 7 that almost all businesses surveyed are aware of business-to-business electronic commerce. Eighty five percent of the entire population are aware of such technology compared to only 15% of respondents that are completely unaware of B2B e-commerce. The respondents that answered 'no' to this question were business owners/managers from small businesses. Therefore, over eighty percent of small business respondents were aware that B2B e-commerce exists. All the business managers surveyed from medium to large organisations indicated they are fully aware of this technology.

Graph 7: Awareness of B2B E-commerce
FINDING OUT ABOUT B2B E-COMMERCE

As mentioned earlier, small businesses run the risk of losing trading partners and revenue if they do not establish B2B electronic commerce facilities to be 'in sync' with the businesses trading partners. Business managers/owners initial hearing about B2B e-commerce from the businesses' trading partners accounts for over thirty two percent of the survey population. Nearly 23% of respondents that have implemented B2B e-commerce indicated they heard of such technology through the media.

Graph 8: Source of Initial knowledge of B2B E-commerce

SELF-RATED KNOWLEDGE OF B2B E-COMMERCE

The level of knowledge owners and managers have of B2B e-commerce can determine the future and success of its implementation within the business. B2B e-commerce knowledge of owners and business managers was measured by a rating scale for those businesses that have implemented the technology, with the results presented in Graph 9. The results indicate that nearly thirty percent of respondent business managers rate their knowledge of B2B e-commerce as medium or intermediate.

Graph 9: Rated B2B E-commerce knowledge

It appears that business managers of medium to large businesses are more likely to have a higher degree of B2B e-commerce knowledge than those owners/managers in small businesses. Some 91% of medium to large business managers indicated they possess a medium or higher level of B2B e-commerce knowledge, compared to only 60% of small business managers indicating B2B knowledge at the same levels.

It is interesting to analyse the retail, information technology, and transport and storage industry and compare the rated knowledge of the businesses in these industries. It is important to note that this comparison among industries include small, medium and large businesses. The results imply that business managers/owners in the retail industry generally rate their B2B e-commerce between low and very low. Having a better understanding than other managers in other industries, information technology industry respondents rated their knowledge
between high and very high (or experts). Finally, all the transport and storage industry businesses surveyed rated their business-to-business e-commerce knowledge as medium.

**Reasons for Adopting E-Commerce**

Only ten percent of small businesses stated they were forced by trading partners to implement B2B e-commerce compared to twenty two percent of medium to large businesses that were forced by the businesses’ influential trading partners (fifteen percent overall). Twenty percent of small businesses and sixteen percent of medium to large businesses revealed they adopted B2B e-commerce in order to keep ahead of the competition. Similarly, twenty percent of small businesses and sixteen percent of medium to large businesses indicated they implemented B2B e-commerce to follow suit of other businesses adopting the same technology.
Almost thirty percent of all respondents stated the ease of document transfer is considered to be the most significant benefit gained from B2B e-commerce implementation within the business environment. Another significant benefit indicated by respondents, twenty five percent, was the cost savings that resulted from the implementation of the technology. Respondents were encouraged to choose more than one benefit if applicable. Eighty percent of small business respondents and eighty five percent of medium to large businesses acknowledged cost savings occurred within the businesses after B2B e-commerce implementation. These results were as expected and consistent with the literature.

**Reasons for Not Implementing B2B E-Commerce**

There are a number of reasons why businesses may be reluctant to implement B2B e-commerce within the organisation. These reasons range from too expensive to security even lack of technical expertise within the business. Graph 12 summarises the results from this question. Twenty three percent of respondents that have not implemented B2B e-commerce revealed that they have not done so as there is a lack of e-commerce knowledge and/or technical expertise within the business. Another nineteen percent of businesses indicated that B2B e-commerce is too expensive to implement and they lack the computer technology within the business.

In comparison, none of the medium to large businesses surveyed indicated they have not implemented B2B e-commerce due to it being too expensive, business not suitable for the technology or preferring face-to-face/other traditional means of communication including telephone, fax, post and so on.
FUTURE STUDIES

Overall, many of the general results reported in this paper are consistent with the literature. Some interesting trends, however, were identified in different industry areas. Small businesses in the information technology industry indicated a high level of expertise, a high level of business document transfer and, thus, a high level of B2B e-commerce adoption. These indicators were not as strong for the retail and transport and storage industries. It will be interesting to further pursue the drivers to this relationship. For instance, is the knowledge of B2B benefits the major driver for its adoption, or the high level of business document transfer? Could it even be possible that the existence of B2B e-commerce in the industry causes a higher rate business document transfer?

CONCLUSION

Results of this study of small business use and attitudes to B2B e-commerce in the Melbourne region have proven to be reasonably consistent with uses and attitudes identified in the literature. Small business respondents had a lower level of business document transfer, lesser awareness of B2B e-commerce and generally rated their own B2B e-commerce knowledge lower than their medium to large counterparts. All of this leads to lower levels of adoption of B2B e-commerce. Of those businesses that have adopted B2B e-commerce, only 15% were forced to by a trading partner. The major benefits gained from its adoption were, not surprisingly, ease of document transfer and cost savings.

Reasons for the non-use of B2B e-commerce were also consistent with those identified in the literature, relating mainly to a lack of knowledge and technical expertise and the cost of the technology.

Some interesting trends were identified in different industry areas. As perhaps could be expected, small businesses in the information technology industry indicated high levels of expertise and business document transfer, and thus a high level of B2B e-commerce adoption. These indicators were not as strong for the other industries.

REFERENCES


Viehland, Dr Dennis, 1998, E-Commerce - Course Notes, Institute of Chartered Accountants in Australia, Melbourne, 3 September.